Criterion Wind Project, Garrett County, Maryland
Indiana Bat Habitat Conservation Plan

November 29, 2011

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

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1.0 INTRODUCTION

1.1 Overview and Background

Criterion Power Partners, LLC (CPP), a wholly owned subsidiary of Constellation Holdings, Inc., owns and operates the Criterion Wind Project (Project). The Project is located on 117 acres of private land in Garrett County, Maryland and consists of 28 wind turbine generators (WTGs), an electrical collection system, and a substation (Figure 1.1). The project has been constructed and in operation since 2010.

CPP has determined that operation of the Project have the potential to kill or injure up to 28 Indiana bats (*Myotis sodalis*), a federally endangered species, over the life of the project. Consequently, CPP is applying for an incidental take permit (ITP) under Section 10(a)(1)(B) of the Endangered Species Act, 16 U.S.C. § 1531 (ESA). The ITP covers project operations and decommissioning over the next 21 years, but is not retroactive to cover past project activities undertaken prior to permit issuance (i.e., construction, operations in 2010-2011). No other listed, proposed, or candidate species are known to occur within the project area.

This Habitat Conservation Plan (HCP), a requirement of the ITP application process, outlines the anticipated impacts of the proposed taking of Indiana bat and how those impacts will be minimized and mitigated to the maximum extent practicable. In addition, the HCP identifies how the conservation plan will be monitored and funded, and alternatives to the taking that were evaluated.

While the Project is located within the Appalachian Mountain Recovery Unit of the Indiana bat range, CPP anticipates the project is relatively low risk based on its specific location. The Project site contains no wintering habitat, is more than 10 miles from a known P3/P4 Indiana bat hibernacula and more than 20 miles from a known P1/P2 hibernacula. There is no evidence of maternity colonies as no Indiana bats were captured in summer mist net surveys and the project is at a high elevation likely to be inhospitable for maternity colonies. However, Indiana bats have been detected on some acoustic surveys and probably do move through the area at times. Existing data from projects in both the Appalachians and the Midwest indicate the greatest likelihood of mortality for bats is in the late summer early fall migration period from July 15-October 15 (Arnett et al. 2008). Thus the impact of this project on Indiana bats is considered low, but the potential for take is possible during fall migration. This relatively low risk of impact to Indiana bats guides the overall conservation plan to further reduce that risk through targeted seasonal curtailment and off-site mitigation to address the remaining potential for incidental take.

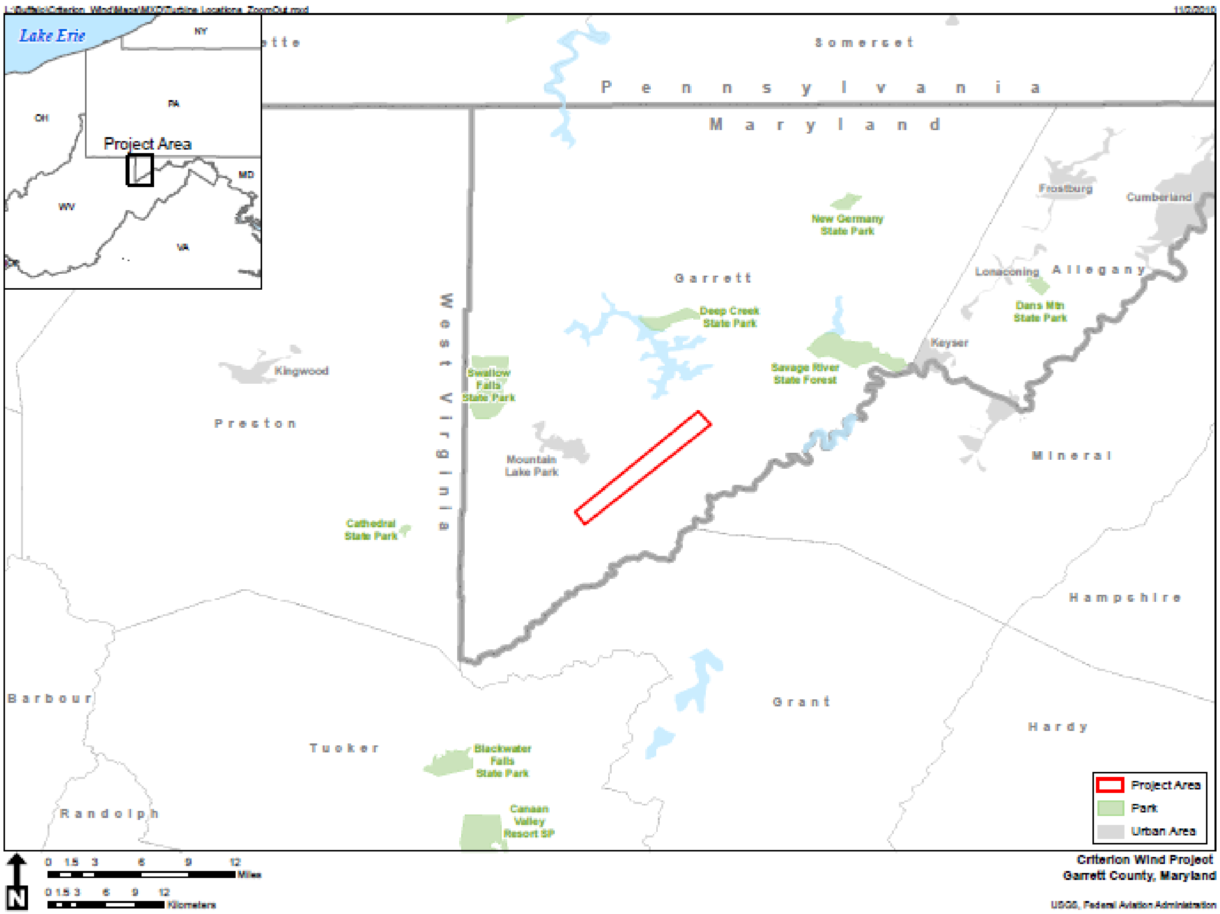

Figure 1.1 Criterion Wind Project location.

1.2 Permit Duration

The proposed term of the ITP is 21 years. This 21-year ITP term allows for operation of the 28-WTG facility over the 20-year functional life of the turbines plus one additional year for decommissioning of the turbines. If at the end of the 20-year operational life of the Project CPP decides that it will continue to operate the facility, it will apply for a new permit or for a permit amendment / extension.

1.3 Permit Area

The proposed permit area for the ITP includes those lands leased by CPP for the operation of the Project (Figure 1.2). The WTGs constructed for the Project are the primary component that may cause take of the Indiana bat; therefore, the permit area includes the locations of all 28 turbines permitted under the Maryland CPCN waiver (Appendix A). The legal description of the permit area is defined in Appendix B. In addition, the permit area includes land leased for other facilities associated with the Project, such as the collection system, switchyard, and meteorological tower.

1.4 Covered Species

CPP is applying for an ITP for the Indiana bat for the covered activities as described below. Indiana bat is currently listed as endangered under the ESA. No other listed, proposed, or candidate species are known to occur within the Permit Area.

During initial consultations with the USFWS it was determined that based on the biology of Virginia big-eared bat (*Corynorhinustownsendii virginianus*) and their known movement patterns, that species is unlikely to occur within the Project and the Project is unlikely to cause take of Virginia big-eared bat. Virginia big-eared bat is an obligate cave-roosting bat and, as such, roosts in specific caves in the winter and summer. There are no known Virginia big-eared bat caves or occurrences in Maryland and the Project is not located between summer and winter habitat, so bats of this species are not expected to travel over the Project during normal dispersal or migration patterns.

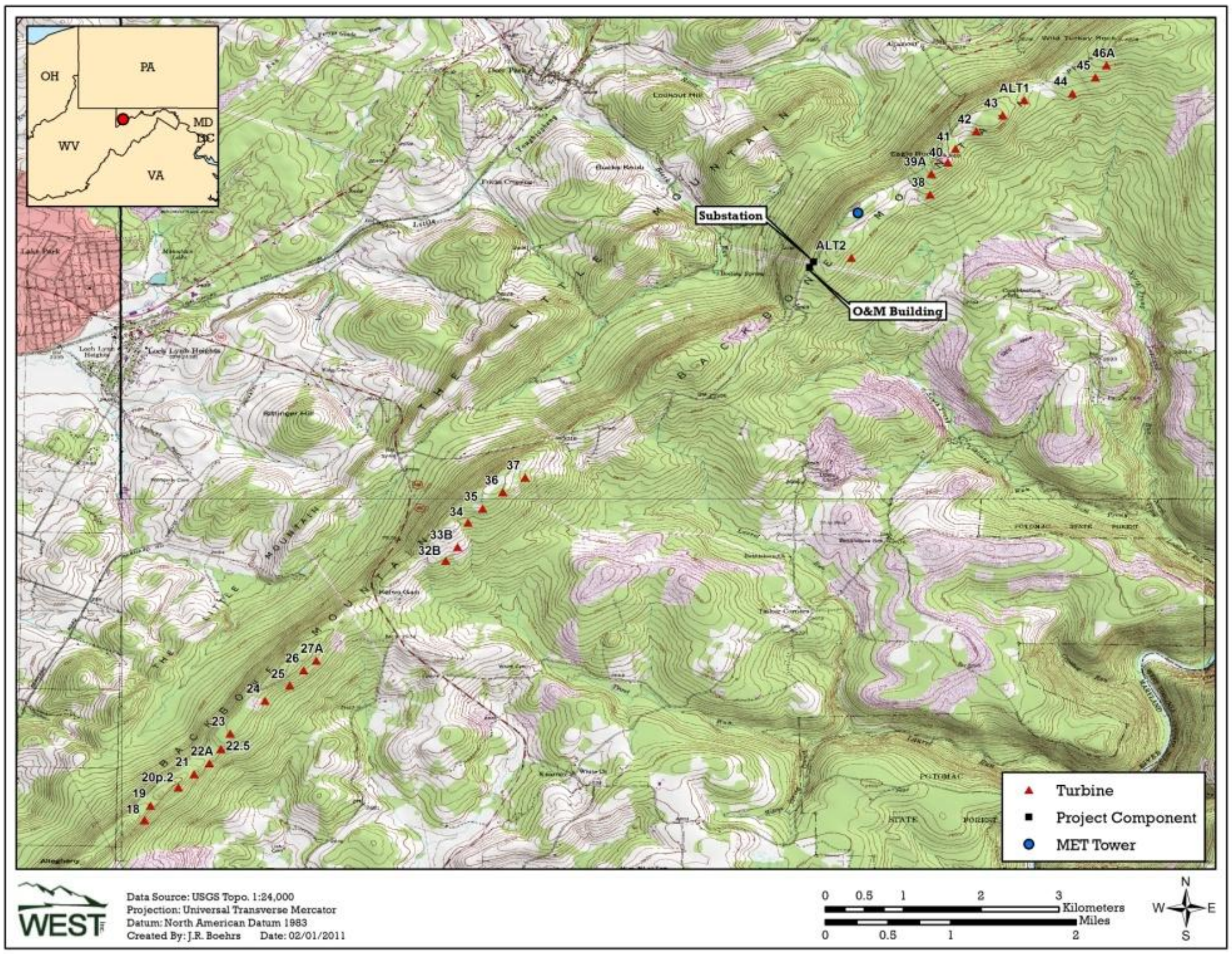

Figure 1.2 Criterion Wind Project facilities.

1.5 Conservation Plan Overview

The following HCP describes the potential take of Indiana bats from the Criterion Wind Project, the potential impacts of such taking, and the measures that CPP will implement to minimize and mitigate the impacts of the taking to the maximum extent practicable. Prior to developing the HCP, CPP incorporated conservation measures during the construction phase (Table 1.1). These are not part of the HCP, but are relevant in describing the baseline from which we examine impacts associated with future activities. These conservation measures were either designed specifically to avoid and minimize impacts to wildlife resources, including as applicable, Indiana bat, or provide an incidental benefit to those species. Through the HCP, CPP proposes to implement other measures specifically intended to minimize and mitigate the impacts of the taking (Table 1.1) and provide the necessary funding to implement the HCP. Furthermore, CPP will monitor compliance with the ITP and verify that the proposed conservation measures are effective at minimizing and mitigating the impacts of the taking.

Table 1.1 Summary of the Criterion Power Partners Habitat Conservation Plan.

Conservation Activities during Siting and Construction (Measures That Define Baseline)	
Avoidance Measures	**Outcome/Benefit**
During project design and planning the total number of turbines was reduced.	Fewer potential risk factors to Indiana bats. Less habitat disturbance.
Majority of tree clearing for the 28 WTGs occurred between November 15 and April 1.	Avoided potential impacts to roosting bats by cutting trees during the hibernation period.
Micro-siting turbines to avoid impacts to rock outcrops and rocky habitat.	This moved turbines away from potential roosting habitat for some species of bat and in particular the state sensitive eastern small-footed myotis.
No new transmission lines were constructed for the project.	Avoided additional habitat impacts. Eliminated a potential risk factor to birds.
Minimization Measures	**Outcome/Benefit**
Facility Siting	Facility was constructed at high elevation where the potential for Indiana bat maternity habitat to be present is minimized.
Pre-construction studies to evaluate potential species presence.	Results confirmed Indiana bats unlikely to occur within Project area.
On-site surveys during construction to investigate presence of Indiana bat.	Tree clearing conducted only upon evidence of probable absence of Indiana bats within the area of interest.
Collection system design and construction.	The collection system was re-routed to avoid additional Indiana bat habitat removal and placed entirely underground.
Turbine pad design and construction.	The turbine pad clearing size was minimized to include only the area required for construction and erection of the towers, with only blade lanes cleared for the assembly and erection of the turbine blades.

Access road design and construction.	Existing access roads within the Project were used to the extent possible to minimize the amount of potential habitat removal.

Conservation Activities during Operations (HCP Measures)	
Minimization Measures	**Outcome/Benefit**
Minimization measures undertaken during construction (see above) will continue to minimize impacts during operations.	Provides habitat that would have otherwise been removed.
WTGs and roads will not be lit except for required FAA lighting on nacelles of select WTGs.	Minimizes attractant (light) to nocturnal migrants and bats reducing added risk factors.
The O&M facility will have downward facing outside safety lights that may be either manually operated or set to operate via motion detectors.	Minimizes attractant (light) to nocturnal migrants and bats reducing added risk factors.
Grounds maintenance and the need for mowing will be evaluated periodically during the growing season and will occur on an annual or as-needed basis.	Minimizes habitat disturbance. Improves conditions for the monitoring study.
Removal of hazard trees adjacent to facilities or roadways will be scheduled to occur after November 15 and before April 1 each year, unless an emergency situation (*e.g.*, a tree falls on a roadway impeding access) requires tree removal outside of this period.	Avoids potential impacts to roosting bats by cutting trees during the hibernation period.
The number of storm water control features in the immediate vicinity of WTGs will be minimized to the extent practicable.	Reduces habitat-attractiveness to bats near turbines.
Turbine Operational changes to include feathering the turbine blades to minimize rotation under 5.0 m/s wind speed from sunset to sunrise between July 15 and October 15 annually.	Based on available data and study results it is likely at least a 50% reduction in bat mortality will be realized during the fall curtailment period through these operational adjustments.
Mitigation Measures	**Outcome/Benefit**
CPP will identify and fund implementation of an Indiana Bat habitat conservation project designed to mitigate the potential incidental take of Indiana bat.	Protection and survival enhancement for Indiana bats.

2.0 PROJECT DESCRIPTION AND COVERED ACTIVITIES

2.1 Project Description

The Project is located east of the town of Oakland in Garrett County, Maryland. Bordered on the north by Pennsylvania, on the west and southeast by West Virginia, and on the east by Allegheny County, Maryland, Garrett County is the state's westernmost county. The Project is a 70 MW wind-energy facility consisting of 28 WTGs and is situated along the ridge of Backbone Mountain extending to the northeast from Allegheny Heights approximately nine miles to just south of Wild Turkey Rock. The topography of the Project area is steeply sloping on the western side of the ridge and relatively gently sloping on the eastern side; and the ridgeline maintains an elevation of approximately 3,200 ft (975 m) above mean sea level (msl). The Project is situated on largely undeveloped, previously logged forestland interspersed with some open farmland and consists of rugged terrain traversed with old logging roads and dotted with seasonally used camps. Land use in the vicinity of the Project is dominated by forest and agriculture, consistent with the rural character of Garrett County, and access to the Project is via Gorman Road, Eagle Rock Road, and Bethlehem Road.

Prior to developing the HCP, CPP incorporated conservation measures during the construction phase that were either designed specifically to avoid and minimize impacts to wildlife resources, or provided an incidental benefit to those species. Aspects of these measures will continue to benefit HCP species and therefore they are included here as part of the Project description.

2.1.1 Project Design and Planning

Wildlife studies conducted during the development phase of the wind-energy facility concluded that Indiana bats were unlikely to occur within the Project (Gates *et al*. 2006). The Project contained no wintering habitat, was more than 10 miles from any Indiana bat hibernacula, the elevation was such that it was unlikely to contain maternity colonies, and no Indiana bats were detected during spring, summer, and fall mist-netting and acoustic surveys. Based on these studies, it was concluded that the overall Project presented a very low risk to Indiana bats (Gates *et al*. 2006). Initial wildlife studies conducted at the Project were for a larger number of WTGs. Since the number of turbines has been reduced the expected impact to Indiana bat (and bats in general) is also reduced. In addition, known cultural resources and State-listed plant and animal species habitat were avoided when the final turbine layout was determined.

2.1.2 Project Construction

To avoid impacts to Indiana bats during the construction phase of the development, the majority of tree clearing for the 28 WTGs occurred between November 15 and April 1 when Indiana bats were not expected to be within the Project. A total of fifty acres of trees were cleared, of which 60% were cleared by April 1 and a further 35% (total 95%) were cleared by the end of April. When trees were required to be cleared after April 15, clearing was only authorized upon evidence of probable absence of Indiana bats within the area of interest. Acoustic (Anabat) monitoring and screening[1] was used initially to determine the potential presence of Indiana bats and if this screening method suggested persistent use by the species in the area of interest, then a comprehensive mist-netting survey was conducted to determine presence or absence (Gruver 2011). Trees were not cleared until absence of Indiana bat was confirmed.

In addition, the following practices were implemented to minimize impacts to Indiana bats during the construction phase of the Project:

- The collection system was re-routed to the extent possible to minimize the amount of potential habitat removal.
- The turbine pad clearing size was minimized to include only the area required for construction and erection of the towers, with only blade lanes cleared for the assembly and erection of the turbine blades.
- Existing access roads within the Project were used to the extent possible to minimize the amount of potential habitat removal.

2.1.3 Project Components

The Criterion Wind Project consists of 28 Clipper 2.5 MW Liberty WTGs. Each turbine site consists of a pad-mounted transformer, power distribution panel, turbine tower, and gravel access drive and buffer area on a total of 1.62 ac. The turbine towers are approximately 262 ft (80 m) in height and have a rotor blade path of 305ft (93 m). Therefore, the maximum height of the turbines from tower base to highest blade tip is 416ft (126 m). The WTGs are arranged in three groups with 11 WTGs in the northern section along the extension of Eagle Rock Road, six WTGs in the center section extending southeast of Bethlehem Road, and the remaining 11 WTGs extending south from King Wildesen Road (Figure 1.2).

One permanent unguyed 240 ft (73 m) tall meteorological tower is located at 1616 Eagle Rock Road. This permanent meteorological tower and its associated electrical components are situated within a 46 ft x 46 ft chain link fenced and graveled yard accessible from the county-maintained Eagle Rock Road by a private gravel road.

The Project includes a substation that feeds electricity into an existing Allegheny Power 138 kV electrical transmission line. The substation contains the Kelso Gap Control Yard and the Criterion Control Yard which are fenced and graveled with their respective Control Houses located directly adjacent to a shared fence that separates the two yards. The Kelso Gap Control House is a 16 ft x 31 ft, one story structure with a low pitched peaked roof occupied by Allegheny Power. The Criterion Control House is a similar structure with dimensions of 13 ft x 25 ft. Housed within the control houses are the relays and protection system, the Supervisory Control and Data Acquisition (SCADA) system, remote terminal units, and batteries. The

[1] Bat calls were screened using three methods to establish the potential occurrence of Indiana bats. (1) Calls were screened through a recognized Indiana bat filter for Anabat data files; (2) a discriminate function analysis was used to determine the probability that a call was produced by an Indiana bat based on statistical comparison with known Indiana bat calls (Gruver *et al.* 2010); and (3) any potential *Myotis* calls were visually screened by a bat biologist with extensive experience identifying Indiana bat calls. If two out of three of these methods identified a call as that of an Indiana bat the call was considered a confirmed Indiana bat call.

balance of the substation equipment consists of breakers, disconnect switches, main transformer, bus work, dead end structures, static masts, and metering. The single-story Operations and Maintenance (O&M) building (4,162 ft^2 (387 m^2) [86.9 ft x 47.9ft]) is located in close proximity to the substation and provides administrative office space, and a maintenance/storage area for the operations and maintenance personnel.

The Project will utilize a satellite system mounted on a stand-alone structure located in the Criterion substation to provide secure high-speed communication capabilities between CPP and Clipper Windpower. This tower will be approximately 10 ft (3 m) tall and is mounted on top of a 2 inch riser pipe. In addition, an H-Frame, housing the communication and phone lines to the control houses and the O&M building, is located on Eagle Rock Road adjacent to a Verizon service shed. The structure consists of three posts mounted in concrete standing 8 ft (2.4 m) above grade with a 10 ft (3 m) span. Communications components are mounted on composite board attached to the structure.

Electrical power generated by the WTGs will be transformed and collected through a network of underground collection circuits. The underground collection cables total approximately 250,000 linear ft (47.6 miles). Much of the collection system runs along Eagle Rock Road and/or Bethlehem Road on the northern portion of the facility property and is buried under the road on the southern portion of the Project. No new transmission lines have been constructed as part of the Project. All existing transmission lines and distribution lines are owned and maintained by Allegheny Power. The collection lines for the WTGs will be owned and maintained by CPP.

2.1.4 Operations and Maintenance

The Project is designed to be operated both locally from the control room in the O&M building, and remotely from Cedar Rapids, IA through Clipper Windpower's RMDC (Remote Monitoring and Diagnostic Center). A permanent staff of approximately ten on-site personnel will provide all O&M support activities to the Project.

The preventative maintenance and inspection schedule for the Project will include daily WTG inspections and routine maintenance activity on WTGs, as required. Some repair activities may require the use of heavy maintenance equipment, such as a lifting crane, to assist in the repairs of components such as the rotor, turbine blades, gearbox, etc.). ASCADA system is installed at the facility in support of daily operations. This system monitors several operating parameters on the WTGs, and if necessary sends alarm messages to the on-call technician via pager or cell phone. An on-call local technician is also available to respond quickly in the event of emergency notification or critical outage.

Maintenance and management of the actual infrastructure and right-of-way areas are the responsibility of CPP. Site management activities will include vegetation management around infrastructure and facilities, including periodic mowing; building inspection and maintenance; periodic maintenance of roads, including grading and contouring to restore the road surface; and annual inspection and maintenance of the collection system route to determine need for mowing or hazard removal. The WTGs and roads will not be lit except for required FAA lighting on the nacelle of select WTGs. The O&M facility will have downward facing outside safety lights that may be either manually operated or set to operate via motion detectors.

Grounds maintenance and the need for mowing will be evaluated periodically during the growing season and will occur on an annual or as-needed basis. Removal of hazard trees adjacent to facilities or roadways will be scheduled to occur after November 15 and before April 1 each year, unless an emergency situation (*e.g.*, a tree falls on a roadway impeding access) requires tree removal outside of this period.

2.1.5 Decommissioning

The projected life of the Project is 20 years. After 20 years, WTGs may be replaced or upgraded for continued operation. Except for the underground collection systems, which are not required to be removed, lease agreements with the landowners provide that all concrete foundations will be removed to a depth of 3ft (0.9 m) below grade following the end of the Project's useful life. The decommissioning process is expected to take a year to complete, plus up to two additional years for the site restoration process, and be similar in scope as the overall construction process. Most components and materials will be recycled and those that cannot will be disposed of in an approved landfill or waste management facility.

Decommissioning Process

All decommissioning and restoration activities will adhere to the requirements of appropriate governing authorities and will be in accordance with all applicable Federal, State, and local permits. The decommissioning and restoration process comprises removal of above-ground structures, concrete foundations to a depth of at least 3ft (0.9 m) below the surface of the property, removal of access roads if required by the landowner, restoration of topsoil, re-vegetation and seeding, and a two year monitoring and remediation period.

Above-ground structures include the WTGs, transformers, Project-owned portions of the substation, maintenance buildings, and telecommunications equipment. Below-ground structures include WTG foundations, collection system conduits, drainage structures, and access road sub-base material. The process of removing structures involves evaluating and categorizing all components and materials into categories of recondition and reuse, salvage, recycling, and disposal. In the interest of increased efficiency and minimal transportation impacts, components and material may be stored on-site in a pre-approved location until the bulk of similar components or materials are ready for transport. The components and material will then be transported to the appropriate facilities for reconditioning, salvage, recycling, or disposal.

WTG removal. Following de-powering, control cabinets, electronic components, and internal cables will be removed. The blades, hub and nacelle will be lowered to grade for disassembly. The tower sections will be lowered to the ground where they will be further disassembled into transportable sections. The blades, hub, nacelle, and tower sections will either be transported whole for reconditioning and reuse or dissembled into salvageable, recyclable, or disposable components.

WTG foundation removal. WTG foundations will be excavated to a depth sufficient to remove all anchor bolts, rebar, conduits, cable, and concrete to a depth of at least 3ft (0.9 m) below grade. The remaining excavation will be filled with clean sub-grade material of quality comparable to the immediate surrounding area. The sub-grade material will be compacted to a density similar to surrounding sub-grade material. All unexcavated areas compacted by equipment used in decommissioning shall be de-compacted in a manner to adequately restore the topsoil and sub-grade material to the proper density consistent and compatible with the surrounding area.

Underground collection cables. The cables and conduits contain no materials known to be harmful to the environment and will be cut back to a depth greater than 3ft (0.9 m). All cable and conduit buried greater than 3 ft (0.9 m) will be left in place and abandoned.

Substation. Disassembly of the substation will be limited to the Criterion side of the substation which is owned by CPP. All System Upgrades made by CPP (including the Kelso Gap substation) and conveyed to Allegheny Power or any improvements made to the local Allegheny Power distribution system will remain in place. Steel, conductors, switches, transformers, etc. will be reconditioned and reused, sold as scrap, recycled, or disposed of appropriately depending upon market value. Foundations and underground components will be removed to a depth of 3ft (0.9 m) and the excavation filled, contoured, and re-vegetated.

Access roads and construction pads. After decommissioning activities of the WTG sites are completed, access roads and construction pads will be removed, unless the landowner requests to maintain the access road. Gravel will be removed from access roads and construction pads and transported to a pre-approved disposal location. Drainage structures integrated with the access road and construction pad will be removed and backfilled with sub-grade material, the topsoil replaced, and the surface contoured and re-vegetated. Ditch crossings connecting access roads to public roads will be removed unless a request is made by the landowner that they remain. Improvements to Town and County roads that were not removed after construction at the request of the Town or County will likely remain in place.

Site Restoration Process

In all areas restoration shall include, as reasonably required, leveling, terracing, mulching, and other steps necessary to prevent soil erosion, to ensure establishment of native vegetation cover, and to control for noxious weeds and pests. A monitoring and remediation period of two years immediately following the completion of any decommissioning and restoration activities will be provided. The two-year period allows for the effects of climatic cycles such as frost action, precipitation, and growing seasons to occur from which various monitoring determinations can be made. During this period any needed follow-up restoration efforts will be implemented. The site restoration process is not anticipated to have any affects to Indiana bats and therefore is not included as a covered activity in the HCP.

2.2 Covered Activities

Covered activities included in the HCP are all actions within the planning area that: (1) are likely to result in incidental take; (2) are reasonably certain to occur over the life of the permit; and (3) for which the applicant has direct control.

Because construction of the Project is complete and the Project became operational by the end of 2010, the activities for which take coverage is sought are those activities related to operations, maintenance, and decommissioning of the Project that are likely to result in take over the life of the permit. CPP has determined that Project activities that could potentially result in take of an Indiana bat include:

(1) operation (running the turbines) of the 28 WTGs over the 20-year functional life of the turbines;

(2) some maintenance activities associated with Project infrastructure; and

(3) decommissioning of the Project infrastructure (excluding the site restoration activities).

CPP proposes conservation measures to minimize and mitigate potential take that may occur as a result of the Project operations, maintenance, and decommissioning. Covered activities under the proposed ITP thus include the activities listed above, plus implementation of conservation measures as described in the conservation plan (see Section 5.0).

2.2.1 Operation of the Project

Commercial operation of the 28 WTGs was achieved on December 27, 2010 and CPP anticipates that the Project will operate for a minimum of 20 years. The spinning rotors and associated changes in air pressure in the rotor-swept area are known to cause collision and barotrauma related mortality among bat species (Arnett *et al*. 2008; Baerwald *et al*. 2008), which could include the Indiana bat. The physical operation of the WTGs within the Project will cause bat casualties and possibly take of Indiana bats; therefore the operation of the WTGs is an activity warranting coverage under the ITP.

Each WTG includes a Supervisory Control and Data Acquisitions (SCADA) operations and communications system that allows automated independent operation and remote supervision of each WTG. The SCADA data provide detailed operating and performance information for each turbine, allowing continuous, real-time control and monitoring to ensure optimal operation and early warning of potential problems. CPP and the turbine supplier (Clipper Windpower, Inc.) control, monitor, and operate the Project through the SCADA system.

2.2.2 Maintenance Activities

General maintenance activities for the wind-energy facility, such as WTG maintenance, road grading, operations and management (O&M) facility upkeep, SCADA upgrades, etc., are not expected to lead to impacts that would rise to the level of take. Maintenance of the WTGs involves periodic activities conducted during daylight hours, typically inside turbines or the O&M building; though occasionally maintenance activities may require the use of a crane to access the rotors or nacelle. These types of activities do not generally present hazards to active bats, as they occur during daylight hours, and do not generate excessive noise or activity that could lead to disturbance of Indiana bats potentially roosting within or near the facility.

While most maintenance activities will not affect Indiana bats, a few activities associated with grounds keeping or hazard tree removal could lead to take by removing a potentially occupied roost site. Specifically, the activity of tree removal for safety reasons or the removal of hazard trees near facilities could result in take if an occupied roost tree were to be cut down. The potential for this activity to lead to take of an Indiana bat is considered low, though it cannot be ruled out for the life of the permit and is included here. However, it is not expected to lead to take above the level determined below (see Chapter 4.0 Impact Assessment/Take Assessment).

2.2.3 Project Decommissioning

At the end of the useful life of the Project (20 years), CPP expects to explore two alternatives. One option is to continue operation through re-commissioning, providing energy under a new contract with a power purchaser. In this case, CPP would reapply for required permits, including an ITP if necessary, to retrofit the WTGs and power system with new technology upgrades, allowing the Project to continue to produce power for additional years. Re-commissioning of the project, if and when it is determined to be necessary, is considered a Changed Circumstance that is addressed below (see Section 8.2 Changed Circumstances)

A second option is to decommission the Project in accordance with landowner easement agreements. Pursuant to the terms of each easement agreement associated with the parcel of land hosting a WTG, CPP is obligated to remove the WTG and the concrete foundation to a minimum of 3 ft (0.9 m) below grade, unless directed by the landowner not to remove such concrete.

If it were determined that the WTGs could not be replaced or repowered after 20 years, CPP will implement the following sequence of activities for removal of the Project components (see also Section 2.1.3).

- Dismantle and remove the WTGs, transmission line, substation, and O&M building.
- Remove pad-mounted transformers, power distribution panels, and collector lines.
- Remove WTGs, O&M building, and substation foundations to a depth of at least 3 ft.
- Grade and re-vegetate disturbed areas and access roads to the original contour, as applicable.

Decommissioning activities are expected to be similar to construction activities but in reverse order where the Project facilities are dismantled and removed from the site (see Section 2.1.4). The majority of decommissioning activities will occur during daylight hours and are unlikely to create hazards for active Indiana bats. Depending on the level of activity and proximity of occupied roosts, these activities have the remote potential to disturb Indiana bats roosting within the Project. Additionally, if any tree removal is required, as with maintenance, take could result if a roost tree occupied by an Indiana bat were to be cut down. In general, decommissioning activities are not expected to result in take of an Indiana bat, and though the possibility cannot be entirely eliminated, decommissioning is not expected to result in take above the level determined below (see Chapter 4.0 Impact Assessment/Take Assessment).

3.0 AFFECTED SPECIES ENVIRONMENTAL SETTING AND BASELINE

3.1 Environmental Setting

The Project is located in the Allegheny Mountain physiographic region of western Maryland (Robbins and Blom 1996), which extends northward into southwestern Pennsylvania and southward into West Virginia. The region is a high plateau with ridges and valleys extending in a predominantly northeast-southwest orientation, and is characterized by rolling and steep hillsides (Kerlinger 2002). Historically, the Allegheny Mountain region was entirely forested; dominated by deciduous trees with some large stands of hemlock (*Tsuga canadensis*) and to a lesser extent white pine (*Pinus strobus*). Trees found at higher elevations within the Project include northern red oak (*Quercus rubra*), red maple (*Acer rubrum*), black cherry (*Prunus serotina*), striped maple (*Acer pensylvanicum*), and a small amount of yellow birch (*Betula alleghaniensis*). Lower elevation trees include sugar (*Acer saccharum*) and red maple, black birch (*Betula lenta*), black cherry, shagbark hickory (*Carya ovata*), and red and white oak (*Quercus alba*).

The Project is situated on largely undeveloped, previously logged forestland interspersed with some open farmland and consists of rugged terrain traversed with old logging roads and dotted with seasonally used camps. Land use in the vicinity of the Project is dominated by forest and agriculture, consistent with the rural character of Garrett County, and access to the Project is via Gorman Road, Eagle Rock Road, and Bethlehem Road. As part of the construction of the project, CPP cleared approximately 50 acres of forested area to install turbine pads and widen roads in the project area.

3.2 Covered Species

3.2.1 Indiana Bat

Indiana bat was included on the list of endangered species in 1967 under the Endangered Species Preservation Act of 1966 prior to the enactment of the Endangered Species Act of 1973, as amended. At the time of listing, primary threats to the species were believed to include loss of habitat and human disturbance especially at winter hibernacula, and a general lack of knowledge about the species biology and distribution (USFWS 1999, 2007).

Life History and Characteristics

Indiana bats exhibit life history traits similar to other temperate vespertilionid bats (Barclay and Harder 2005). Similar to most temperate *Myotis* species, female Indiana bats give birth to one offspring per year (Humphrey *et al*. 1977; Kurta and Rice 2002). Mating occurs in the vicinity of the hibernacula in late summer and early fall and fertilization is delayed until the spring (Guthrie 1933). Timings of parturition and lactation are likely dependent in part on latitude and weather conditions. For example, in Iowa, female bats arrive at maternity roosts at the end of April and parturition is completed by mid-July (Clark *et al*. 1987); in Michigan, young are born in late June or early July (Kurta and Rice 2002); and in southern Indiana, pregnant females are known from 28 May through 30 June while lactation has been recorded from 10 June to 29 July (Whitaker and Brack 2002). Young bats are volant within 3 to 5 weeks of birth, at which time the maternity colony begins to disperse and use of primary maternity roosts diminishes. Females and juveniles may remain in the colony area until migration to the hibernacula; however, at this time the bats become more gregarious. It is likely that once the young are born, females leave their pups in the diurnal roost while they forage, returning during the night periodically to feed them (Barclay and Kurta 2007). Females will, however, switch roost trees regularly and during these switches they likely carry flightless young. Indiana bat maternity colonies will use several roosts; in Missouri each maternal colony used between 10 and 20 separate roost trees (Miller *et al*. 2002). In Kentucky, Gumbert *et al*. (2002) recorded 463 roost switches over 921 radio-tracking days of tagged Indiana bats - an average of one switch every 2.21 days. Consecutive use of roost trees by individual bats ranged from 1 to 12 days. There are a number of suggested reasons for roost switching; including thermoregulation, predator avoidance, and reduced suitability of roost trees - an ephemeral resource and can become unusable if they are toppled by wind, lose large pieces of bark, or are otherwise destroyed (Kurta *et al*. 2002, Barclay and Kurta 2007).

Indiana bats return to the vicinity of the hibernaculum in late summer and early fall where they exhibit a behavior known as “swarming”. This involves large numbers of bats flying in and out of the cave entrances from dusk to dawn, though relatively few of the bats roost in the cave during the day (Cope and Humphrey 1977). During the swarming period most Indiana bats roost within approximately 1.5 miles (2.4 km) of the cave, suggesting that the forests around the caves provide important habitat prior to hibernation (USFWS 2007). It is at this time that bats gain fat stores vital for winter survival but also when mating occurs. While females enter the hibernaculum soon after arrival at the site, males remain active for a longer period and may also travel between hibernacula - both of which may increase mating opportunities (USFWS 2007).

Spring emergence from the hibernacula generally occurs from mid-April to the end of May and varies across the range, depending on latitude and weather conditions. Females typically emerge before males, traveling sometimes hundreds of miles to their summer habitat (Winhold and Kurta 2006). Exit counts from Big Springs Cave in Tucker County, West Virginia, suggest that peak spring emergence typically occurs in mid-April (USFWS 2007).

Habitat Requirements

Indiana bats have two distinct habitat requirements; (1) a stable environment in which to hibernate during the winter, and (2) deciduous woodland habitat for maternity roosts in the summer. Males may use hibernacula or tree roosts during the summer and prior to hibernation both males and females roost in wooded habitat in the vicinity of the hibernacula.

Winter Habitat

Indiana bats generally hibernate between October and April, although this may be extended from September to May in northern parts of their range (USFWS 2007). The majority of hibernacula are located in karst areas of the east-central U.S.; however, they are known to hibernate in other cave-like locations such as abandoned mines, buildings, a railroad tunnel in Pennsylvania, and a hydroelectric dam in Michigan (Kurta and Teramino 1994, Hicks and Novak 2002, Butchkoski and Hassinger 2002a, USFWS 2007). Indiana bats typically require low, stable temperatures (3 to 8°C) for successful hibernation (Brack 2004, Tuttle and Kennedy 2002); and, in general, the caves in western Maryland appear to have temperatures too high to support hibernating Indiana bats (Dana Limpert MDNR; pers. comm.). Caves with the highest Indiana bat populations are typically large, complex systems that allow air flow, but their volume and complexity often buffer or slow changes in temperature (Brack 2004). These caves often have large rooms or vertical passages below the lowest entrance that allow entrapment of cold air that is stored throughout the summer, providing arriving bats with relatively low temperatures in early fall (Tuttle and Kennedy 2002). Bats are also able to decrease exposure to fluctuating air temperatures by increasing surface contact with the cave or other individuals and as such Indiana bats tend to hibernate in large, dense clusters ranging from 300 to 500 bats per square foot (USFWS 2007; Boyles *et al*. 2008). Indeed, it is suggested that in areas where populations are low, Indiana bats hibernate with other species (such as little brown bats) to gain this thermoregulatory advantage (USFWS 2007).

Spring, Summer, and Fall Habitat

Females. Following hibernation, female Indiana bats may travel up to 350 miles to their summer habitat where they form maternity colonies (Winhold and Kurta 2006); though individuals radio-tracked in the northeastern US appear to travel much shorter distances (< 35 miles; Hicks 2006, USFWS 2007). Members of a maternity colony do not necessarily overwinter in the same hibernacula, with individuals from a single maternity colony shown to hibernate in locations almost 200 miles apart (Kurta and Murray 2002, Winhold and Kurta 2006); though colonies do appear to be highly philopatric, using the same areas and same roosts in successive years (Barclay and Kurta 2007, Callahan *et al*. 1997, Humphrey *et al*. 1977).

In the summer, female Indiana bats predominantly roost under slabs of exfoliating bark, preferring not to use tree cavities, such as those created by rot or woodpeckers, but occasionally using narrow cracks in trees (Kurta 2004). Due to their cryptic nature, the first Indiana bat maternity colony was only located in 1971 (Cope *et al*. 1974, Gardner and Cook 2002); however, since that time, much of the work pertaining to summer Indiana bat habitat has concentrated on identifying and describing maternity colonies. Maternity colonies vary greatly in size in terms of number of individuals and number of roost trees used, with members of the same colony utilizing over 20 trees during one season (Kurta 2004). Roosts are usually located in dead trees, though partly dead or live trees (for example, if the species has naturally peeling bark) may also be used (USFWS 2007). A meta-analysis of 393 roost trees in eleven states found 33 tree species that were used, with ash (*Fraxinus* sp.), elm (*Ulmus* sp.), hickory (*Carya* sp.), maple (*Acer* sp.), poplar (*Populus* sp.), and oak accounting for 87% of trees documented (Kurta 2004). Of the nine roost trees identified as summer habitat in West Virginia eight were snags, and one was a live-damaged tree (Beverly and Gumbert 2004). The four species identified, were basswood (*Tilia americana*), sugar maple (*A. saccharum*), northern red oak (*Quercus rubra*), and scarlet oak (*Q. coccinea*). Roost trees also vary in size. The smallest maternity roost tree recorded was 4 in (11 cm) DBH (diameter at breast height; Britkze 2003) and in West Virginia size ranged from 5.3 to 13.0 in (13.6 to 33.0 cm) DBH (Beverly and Gumbert 2004). It is more typical, however, for trees greater than 9 in (22 cm) DBH to be utilized (Kurta 2004) and the mean size from the aforementioned meta-analysis was 18±1 in (45±2 cm; range 11 to 24 in [28 to 62 cm]; Kurta 2004, Britzke*et al*. 2006). An important characteristic for the location of maternity roost sites is a mosaic of woodland and open areas, with the majority of maternity colonies having been found in agricultural areas with fragmented forests (USFWS 2007). Further, absolute height of the roost tree appears to be less important than the height of the tree relative to surrounding trees with roost trees often extending above the surrounding canopy (Kurta 2004).

Maternity colonies use primary roosts and alternate roosts. Primary roosts were defined by Callahan (1993) in terms of number of bats (*i.e*. roosts used by > 30 bats), but may also be defined by the number of bat-days they are used over one maternity season (Kurta *et al*. 1996, Callahan *et al*. 1997, USFWS 2007). Primary roosts are used throughout the summer, while alternate roosts are used less frequently and may be important during changing weather conditions (temperature and precipitation), or when the primary roost becomes unusable (Callahan *et al*. 1997). Primary roosts are often found near clearings or edges of woodland where they receive greater solar radiation, a factor that may be important in reducing thermoregulatory costs for reproductive females and their young (Vonhof and Barclay 1996). Female Indiana bats are able to use torpor to conserve energy during cold temperatures; however, torpor slows gestation (Racey 1973), milk production (Wilde *et al*. 1999), and juvenile growth, and is costly when the reproductive season is short (Hoying and Kunz 1998; Barclay and Kurta 2007). The majority of maternity colonies have been found at relatively low elevation (< 900 m) where temperature and growing season tend to be more favorable for rearing pups. One exception is a colony that has been reported from an elevation of 1,158 m (approximately 3,800 ft) in the Nantahala National Forest North Carolina (Britzke *et al*. 2003); however, it is likely that the latitude of this site allows for slightly higher elevation.

While the primary roost of a maternity colony may change over the years, it is thought that foraging areas and commuting paths are relatively stable (Barclay and Kurta 2007). Members of a maternity colony in Michigan used a wooded fence-line as a commuting corridor for nine years (Winhold *et al*. 2005). In general, the distance from the roost to foraging areas varies from 0.3 to 5.3 mi (0.5 to 8.4 km; USFWS 2007); and this distance may be constrained by the need to return to the roost periodically once the young are born (Henry *et al*. 2002). Indeed, lactating females have been shown to return to the roost two to four times during a night (Butchkoski and Hassinger 2002b, Murray and Kurta 2004). In Michigan, the mean distance from the roost to the nearest edge of an activity center was 1.5 mi (2.4 km; range: 0.3 to 2.6 mi [0.5 to 4.2 km]; Murray and Kurta 2004); in Indiana, eleven females used foraging areas on average 1.9 mi (3.0 km; range: 0.5 to 5.3 mi [0.8 to 8.4 km]; Sparks *et al*. 2005) from their roosts; and in Pennsylvania this distance was 1.7±0.6 mi (2.7±0.9 km; range: 0.8 to 3.3 mi [1.3 to 5.3 km]; Butchkoski and Turner 2005). On average, females switch roosts every two to three days and may come back to the same roost trees periodically. Roost switching is likely dependent upon factors such as reproductive condition, roost type, roost condition, time of year, and predation (Kurta *et al*. 2002, USFWS 2007). Although individuals from a maternity colony appear to show fidelity to a general home range within and between years (Sparks *et al*. 2004); due to the differences in methodology it is difficult to determine a common home range size (Lacki *et al*. 2007). In Indiana, mean home range was 0.56 mi^2 (145±18 ha; Sparks *et al*. 2005); while on the Vermont-New York state-line it was 0.32 mi^2 (83±82 ha; Watrous *et al*. 2006). Both of these estimates are higher than for a single female in Pennsylvania who's home range was estimated at 0.08 mi^2 (21 ha; Butchkoski and Turner 2006). As well as differences in methodology, the range of home ranges estimated likely reflects differences in habitat quality between sites.

Demographics

Very little is known about annual survival rates for Indiana bats, either for adults or juveniles, and little is known about background mortality of the species (USFWS 2007). It is expected however, that, similar to many other species, survival of Indiana bats is lowest during the first year of life and threats and sources of mortality vary during the annual cycle. During summer months, sources of mortality may include loss or degradation of forested habitat, predation, human disturbance, and other man-made disturbances (Kurta et al. 2002, USFWS 2007); while during the winter months, impacts may include disturbance or modifications at the hibernacula and surrounding areas that physically disturb the bats or change the microclimate within the hibernacula (USFWS 2007). Human disturbance during hibernation may cause a threat through direct mortality caused by disruption of normal hibernation patterns. In addition, other sources of winter mortality may include natural predation, natural disasters that impact hibernacula, and WNS, which currently is impacting hibernating bats more than any other perturbation.

In a study in Indiana, survival rates among male and female bats ranged from 66% to 76% for six to ten years after marking, with female longevity approximately 12 to 15 years and males 14 years (Humphrey and Cope 1977). The oldest known Indiana bat was captured 20 years after the first capture (La Val and La Val 1980). Research from banding studies during the 1970's suggests that adult survival during the first six years varies from approximately 70-76% annually (Humphrey and Cope 1977, USFWS 2007, O'Shea *et al.* 2004). After this period, annual survival varied from 36-66% and after 10 years drops to approximately 4% (Humphrey and Cope 1977). There is less information available on juvenile survival, with one published study suggesting a juvenile mortality rate of 8% based on observations at a maternal colony over a two-year period (Humphrey *et al.* 1997). More research is needed to define annual survival rates of Indiana bats more accurately; however, available information suggests that annual mortality is likely to be between 8% and 30% during the first 10 years of life (USFWS 2007).

O'Shea *et al.* (2004) summarize survival rates for a number of species, including little brown bat, which is used as an Indiana bat surrogate for the analysis in this HCP. The range of survival rates cited varies considerably from approximately 13-86% (O'Shea *et al.* 2004). Other *Myotis* species also had variable survival rates, ranging from 6-89%; however, in general studies indicated that survival for first year juveniles was generally lower than for adults.

As with mortality or survival rates for Indiana bats, little is known about recruitment rates for the species; however, female Indiana bats typically give birth to one young per year (Mumford and Calvert 1960, Humphrey *et al.* 1977, Thomson 1982). The proportion of females in a population that produce young in a year is thought to be fairly high (USFWS 2007). In one study, greater than 90% of the females produced young each year (Humphrey *et al.* 1977) and in another it was estimated that 89% of adult females were reproductively active annually (Kurta and Rice 2002). Location and environmental factors likely influence reproductive rate and there is concern that environmental threats such as WNS may lead to lower reproduction rates (USFWS 2010). Recruitment in the total Indiana bat population over the past five-year period has been variable by region with the Ozark-Central, Midwest, and Northeast Recovery Units showing decreasing trends from approximately 5-38% between 2007 and 2009; while in the Appalachian Mountain

Recovery Unit the Indiana bat population has exhibited an increasing trend and a two-year net increase of approximately 36% between 2007 and 2009 (USFWS 2011).

Range and Distribution

The range of the Indiana bat extends throughout much of the eastern US and includes 22 States (Gardner and Cook 2002, USFWS 2007; Figure 3.1). Over the past 40 years, general population trends of Indiana bats appear to be decreasing in the southern and increasing in the northern regions of its range (USFWS 2007, 2010a). Historically, Indiana bat winter range was restricted to areas of cavernous limestone in the karst regions of the east-central US, apparently concentrated in a relatively small number of large, complex cave systems. These included Wyandotte Cave in Indiana; Bat, Coach, and Mammoth Caves in Kentucky; Great Scott Cave in Missouri; and Rocky Hollow Cave in Virginia. More recently, increasing numbers of Indiana bats have been found using man-made structures such as mines, tunnels, and buildings, as well as natural caves, for hibernation; thereby extending their winter range into some caveless parts of the country (Kurta and Teramino 1994). For example, Indiana bats have been found hibernating in several man-made tunnels and a church in Pennsylvania (Butchkoski and Hassinger 2002a); and in 1993, an Indiana bat was discovered hibernating in a hydroelectric dam in Manistee County, Michigan 281 miles (450 km) from the closest recorded hibernaculum for Indiana bat in LaSalle County, Illinois (Kurta and Teramino 1994). In 2005, approximately 30% of the population hibernated in man-made structures (predominantly mines), with the rest using natural caves (USFWS 2007). As of November 2006 there were 281 known extant Indiana bat hibernacula in 19 states (USFWS 2007). Over 90% of the population hibernated in just five states: Indiana (45.2%), Missouri (14.2%), Kentucky (13.6 %), Illinois (9.7%), and New York (9.1 %); with 71.6% hibernating in just 10 caves. Overall, approximately 82% of the estimated total population in 2006 hibernated in 22 of the 23 Priority 1 hibernacula (USFWS 2007).

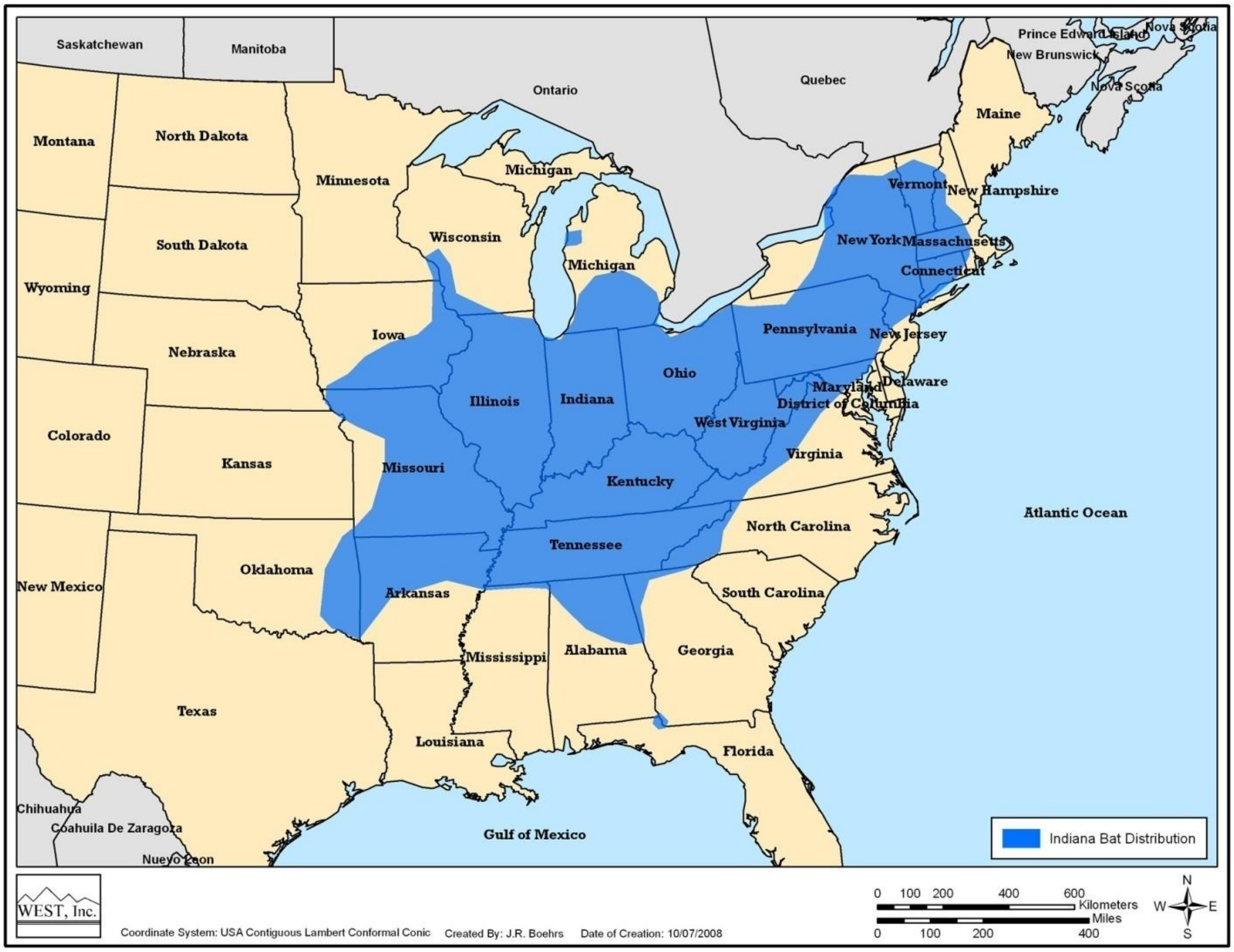

Figure 3.1 Approximate range of the Indiana bat in the U.S.

It is believed that the historical summer distribution was similar to that of today, however, the first maternity colony was not discovered until 1971 (Cope *et al.* 1974). As of October 2006, the USFWS had records of 269 maternity colonies in 16 states. This likely represents only 6-9% of the 2,859 to 4,574 colonies thought to exist based on the estimated total wintering population (Whitaker and Brack 2002, USFWS 2007). The distribution of Indiana bat summer habitat in the east appears to be less extensive than in the Midwest (see range maps in USFWS 2007), which may be due to the geographic distribution of important hibernacula or to differences in climate and elevation that may limit suitable summer colony sites in this location. Summer temperatures at increasing elevation are typically cooler and/or wetter, which may influence the energetic feasibility of reproduction in some eastern areas (Brack*et al.* 2002). The proportion of reproductively active Indiana bats in West Virginia, Virginia, and Pennsylvania, where there is a 6.4 °C (44 °F) decrease in temperature for each increase of 3280 ft (1,000 m), decreased with increasing elevation (Brack*et al.* 2002). In addition, the summer temperatures of portions of Indiana bat range in the east are slightly cooler than in the core part of the range in Indiana, Kentucky, and Missouri (Brack*et al.* 2002, Woodward and Hoffman 1991).

Dispersal and Migration

Fleming and Eby (2005) categorized bat species based on movement patterns: (1) sedentary species: breed and hibernate in the same local areas usually moving less than 30 mi (50 km) between summer and winter roosts; (2) regional migrants: migrate moderate distances between 60 to 310 mi (100 to 500 km,); and (3) long-distance migrants: have highly developed migratory behavior sometimes traveling greater than 620 mi (1,000 km) between summer and winter roosts. Dispersal distance of Indiana bats from winter hibernacula to summer roost sites varies geographically, categorizing them between sedentary and regional migrant depending on location. In Michigan, 12 female Indiana bats moved on average of 296 mi (477 km) to their hibernacula in Indiana and Kentucky (Winhold and Kurta 2006). In contrast, based on study of more than 100 tagged Indiana bats in New York, dispersal movements were typically less than 35 mi (60 km) and in many cases only a few miles from the hibernacula (A. Hicks, NYSDEC, pers. comm.). In general, based on results of studies to date, summer range of Indiana bats could be any suitable habitat within approximately 200 mi (320 km) of a known winter hibernaculum.

Little is known about behavior of Indiana bats during migration. Evidence from radio-tracking studies in New York and Pennsylvania indicate that Indiana bats are capable of migrating at least 30-40 mi (48-64 km) in one night (Sanders *et al.* 2001, Hicks 2004, Butchkoski and Turner 2006). It appears that Indiana bat migration from winter to summer habitat is fairly linear and short-term, while in the fall it is more dispersed and varied, with some studies showing that individuals may travel between 9-17 mi (14-27 km) from a summer roost site to a hibernaculum cave where swarming occurs (USFWS 2007). In addition, males and females appear to display different dispersal behavior, with females moving quickly between the hibernacula and maternal colonies, while males commonly remain in the proximity of the hibernacula (USFWS 2007).

Species Status and Occurrence

Nationwide. A key component to the survival and recovery of the Indiana bat is maintenance of suitable hibernacula that insure the over-winter survival of sufficient individuals to maintain population viability. The Draft Indiana Bat Recovery Plan (USFWS 2007) categorizes hibernacula into four groups based on the priority to the species population and distribution. Priority 1 hibernacula are essential to the recovery and long-term conservation of the species and have a current or historically observed winter population of ≥10,000 individuals. Priority 2 hibernacula contribute to the recovery and long-term conservation of the species and have a current or historical population of >1,000 but <10,000 individuals. Priority 3 sites have a current or historical population of 50-1,000 bats and Priority 4 sites have a current or historical population of fewer than 50 bats.

Since the release of the first Indiana Bat Recovery Plan (USFWS 1983), in an effort to monitor the overall Indiana bat population, the USFWS implemented a biennial monitoring program at Priority 1 and 2 hibernacula (USFWS 2007). In 1965, the overall population was estimated to be over 880,000 individuals; however, while variation in the data collection apparently has led to variable estimates, in general, there has been a long-term declining population trend to approximately 380,000 individuals in 2001. Since then the population has shown a gradual increase to 468,184 in 2007; however, due to the recent effects of WNS the estimated population fell to 417,185 in 2009, decrease of 10.8% in two years (USFWS 2011).

General patterns in the overall population estimates have shown a decreasing trend through the core range of the species in the Midwest and increasing trends on the periphery and more northern states (USFWS 2007). The causes of these population changes are unknown; however, climate change may play a role by negatively affecting hibernacula temperature (USFWS 2007). More recently, populations in the northeastern and eastern US have been affected by WNS which is having a dramatic effect on some populations, such as in Vermont (Frick *et al*. 2010). WNS is caused by the fungus *Geomyces destructans* and has caused the deaths of over a million bats in the northeastern US, including Indiana bats (See Section 4.3.4). The condition is associated with loss of winter fat stores, pneumonia, and the disruption of hibernation and feeding cycles and mortality rates have been shown to exceed 90% over two years in many infected caves.

Appalachian Mountain Recovery Unit. The Draft Indiana Bat Recovery Plan divides the species range into four recovery units based on several factors, such as traditional taxonomic studies, banding returns, and genetic variation (USFWS 2007). The Project falls within the Appalachian Mountain Recovery Unit (AMRU) which includes the states of Pennsylvania, Maryland, Virginia, West Virginia, North Carolina and the far eastern section of Tennessee (USFWS 2007). According to the Draft Indiana Bat Recovery Plan (USFWS 2007), the Revised 2007 Rangewide Population Estimate (USFWS 2008), and the Revised 2009 Rangewide Population Estimate (USFWS 2011), the overall population within the AMRU was approximately 22,483 in 2007 and 30,308 in 2009 - an increase of 35.9% (Table 3.1; USFWS 2007, 2008, 2011). The AMRU represents approximately 7.3% of the 2009 rangewide population of Indiana bats (USFWS 2011). There are 88 known Indiana bat hibernacula within the AMRU, with 55 being classed as extant (at least one record since 1995; USFWS 2007). There are two Priority 1 hibernacula in the AMRU - Hellhole Cave (WV) and White Oak Blowhole (TN), both of which are designated Critical Habitat for Indiana bats. These two Priority 1 hibernacula had estimated populations of 12,858 and 5,481 Indiana bats, respectively, in 2007 (USFWS 2009) and 14,855 and 11,058 Indiana bats, respectively, in 2009; represent approximately 96% of the total number of Indiana bats in the Recovery Unit.

Table 3.1 Indiana bat population estimates for the Appalachian Mountain Recovery Unit (USFWS 2011).

State	2001	2003	2005	2007	2009
Pennsylvania	702	931	835	1038	1031
Maryland[1]	-	-	-	-	-
West Virginia	9,714	11,444	13,417	14,745	17,705
Virginia	596	728	567	535	513
North Carolina	0	0	0	0	1
East Tennessee	5,372	6,556	8,853	5,977	11,058
Total	**16,384**	**19,659**	**23,672**	**22,295**	**30,308**

[1] No P1 or P2 hibernacula are present in Maryland, therefore, no data reported USFWS 2008, 2011;

Maryland. Biannual surveys for hibernating Indiana bats are conducted at P1 and P2 hibernacula. For this reason, and since there are no P1 or P2 hibernacula in the Maryland, there are limited data for Indiana bat populations in the State. According to the Draft Indiana Bat Recovery Plan, there are three hibernacula in Maryland (USFWS 2007); all are P4 hibernacula with a maximum population estimate since 2000 of zero. The hibernacula are located in Allegany, Garrett, and Washington Counties. In addition, there are two known extant maternity colonies in Carroll County and other summer records (males or non-reproductive females) in Garrett and Washington Counties (USFWS 2007). The John Friend hibernaculum in Garrett County is owned by The Nature Conservancy and has a maximum all time population estimate of five individuals.

Project Site / Local Population. Existing information suggests that the occurrence and abundance of Indiana bats within the Project is likely to be low. Based on the available information, results of site surveys (Gates *et al.* 2006; Gruver 2011), and distance to the nearest known hibernacula, it is assumed that Indiana bats may move through the area from approximately April 1 through November 15. No Indiana bats are expected to be in the Project from November 15 through March 31 during hibernation. The elevation of the Project (approximately 975 m) means that the likelihood of a maternity colony on the site is low. There is the potential for male Indiana bats to occur within the Project between April and November, and there are summer records of either males or non-reproductive females in Garrett County. Mist-netting surveys were conducted within the Project in September 4-10, 2003, May 18-24, 2004, and June 23-30, 2004 during which time 36, 10, and 11 bats were caught, respectively. No Indiana bats were caught within the Project (Table 3.2; Gates *et al*. 2006). Further, mist-netting surveys conducted in part of the Project in June, July, and August 2010 also captured no Indiana bats (Table 3.2; Gruver 2011). Acoustic (Anabat) surveys were conducted for two-night survey periods at four locations in early September, mid-May, and late-June (Gates *et al.* 2006). Of the calls identified to species, none were identified as Indiana bat. Additional acoustic (Anabat) surveys were conducted in 2010 from April 1 through November 15 (Gruver 2011). A total of 912 detectors-nights were accumulated over the study period and 57,112 bat calls were recorded. Of the bat calls, 43,953 (77%) were high-frequency (HF) calls (those >35 kHz) which generally include the *Myotis* species of bats. A total of 12,000 HF calls were of sufficient quality to be screened with a Discriminant Function Analysis (DFA) to statistically classify the call sequence based on 11 parameters of the call. Of all the HF calls, 46 calls (~0.10%) were treated as Indiana bat calls based on the analyses (see Gruver 2011 for details of the analyses). Results of this study suggested Indiana bats may have been present within the Project in early June and mid-August. However, the overall activity level for suspected Indiana bats was very low and no individuals were recorded or trapped during mist-netting surveys at the end of June/early July (Gruver 2011). These results corroborate the findings of this HCP that Indiana bats are unlikely to maintain maternity colonies on or near the site, likely due to elevation, but that they may pass though the site either during migration seasons or simply as transient males or non-reproductive individuals.

Table 3.2 Results of mist-netting surveys conducted within the Project prior to and during construction.

Common name	Scientific name	September 2003	May 2004	June 2004	June-August 2010	Total
Indiana bat	*Myotis sodalis*	0	0	0	0	**0**
Little brown bat	*Myotis lucifugus*	19	3	2	9	**33**
Northern long-eared bat	*Myotis septentrionalis*	9	4	4	8	**25**
Big brown bat	*Eptesicus fuscus*	-	-	4	7	**11**
Tricolored bat	*Perimyotis subflavus*	-	-	-	1	**1**
Eastern red bat	*Lasiurus borealis*	7	3	1	4	**15**
Hoary bat	*Lasiurus cinereus*	1	-	-	-	**1**
Unidentified bat		-	-	-	1	**1**
Total		**36**	**10**	**11**	**29**	**87**

4.0 IMPACT ASSESSMENT / TAKE ASSESSMENT

Based on the best available scientific information, CPP estimates that the operation and decommissioning of the wind-energy facility may result in the take of up to 28 Indiana bats over the 21-year project duration, prior to implementing the HCP measures. Information supporting this estimate is provided in this chapter. The take estimate range was developed using information from a combination of onsite surveys, other wind-energy facilities, data from State wildlife agencies, and available scientific literature. As described below (Section 4.1.2), little brown bat (*Myotis lucifugus*) was used as a surrogate indicator species and it is believed that the determined range provides a reasonable estimate of potential take of Indiana bats.

Note that this HCP addresses impacts from operation and decommissioning of the wind-energy facility. The Project was constructed prior to the HCP and therefore construction related effects are not addressed in the plan. However, it should also be noted that forested ridge top habitat is not limiting for Indiana bats in the project vicinity.

4.1 Anticipated Take

4.1.1 Direct Effects

Bat fatalities and injuries have been reported at all of the wind-energy facilities where post-construction monitoring studies have been conducted. Fatalities have been determined to be due to both collision with turbine blades and barotrauma, caused by rapid pressure changes near the blades (Baerwald *et al.* 2008). Although there is regional, temporal, and species-specific variation in the levels of mortality that have been observed at monitored wind-energy facilities across the US (see summaries in Arnett *et al*. 2008, Johnson 2005); studies do show several general trends:

- Impacts to bats from wind turbines are unequal across species. The majority of bat fatalities at wind-energy facilities across North America have been tree-roosting, long-distance migrant species, such as hoary bats (*Lasiurus cinereus*), eastern red bats (*L. borealis*), and silver-haired bats (*Lasionycteris noctivagans*; Arnett *et al*. 2008, Johnson 2005). In some eastern studies, fatalities also include a number of tri-colored bats (*Perimyotis subflavus*), a cave-hibernating regional migrant (Arnett *et al*. 2008). Within the eastern US, the least common bat species found during fatality monitoring are big brown bat (*Eptesicus fuscus*) and *Myotis* species (Arnett *et al*. 2008, Johnson 2005).

- Impacts to bats from wind-energy facilities are unequal across seasons. The highest mortality appears to occur during what is believed to be the post-reproductive dispersal or fall migration period, from approximately late-July to mid-September. This trend is exhibited in numerous studies across North America (Arnett *et al*. 2008, Johnson 2005).

- There is no clear relationship between number of bat fatalities and habitat type. While it has been hypothesized that wind-energy facilities situated on deciduous forested ridgelines in the eastern US may pose a higher risk (Arnett *et al*. 2005), high bat mortality has also been documented at wind-energy facilities in prairie/agricultural settings (Baerwald 2007) and mixed deciduous woods and agricultural settings (Jain *et al*. 2007, Gruver *et al*. 2009) in the Midwest and Canada.

- Predicting the impacts of a wind-energy facility to bats is difficult based on the current available information. To date, results from post-construction monitoring surveys conducted at existing sites within the same geographical region appears to be the best available predictor for mortality levels and species composition at new or proposed wind-energy facilities (*e.g.*, see Johnson and Erickson 2008, Arnett *et al*. 2008). This Project is more similar, in terms of habitat and topographical characteristics, to other Appalachian-region wind-energy facilities than to sites in, for example, the Midwest or northeastern US. For this reason, it is likely that the impacts to bats caused by the Project will be similar to those of sites in West Virginia and Pennsylvania.

4.1.2 Estimating Take of Indiana Bats

To date, three Indiana bat fatalities have been recorded at a wind-energy facilities where post-construction fatality monitoring has been conducted (Parham 2010, S. Pruitt, USFWS, 2010, pers. comm., USFWS Pennsylvania Field Office http://www.fws.gov/northeast/pafo/). Two of the fatalities occurred during mid-September at a wind-energy facility in Indiana that is located in an agricultural setting. The third fatality occurred at a wind project in Pennsylvania in late September. Little can be derived from these discoveries other than that the species is vulnerable to collision with wind turbines and the collisions occurred during what is likely the fall migration and swarming season for Indiana bats.

Site-specific mist-net surveys conducted at the Project in 2003, 2004, and 2010 failed to confirm the presence of Indiana bat (Gates *et al.* 2006, Gruver 2011); however, acoustic data collected in 2010 indicate that they were using the site during the early summer and fall (Gruver 2011).

Taking into account the uncertainty with how Indiana bats may use the project site and the difficulty in directly quantifying or detecting take of Indiana bats in general, CPP proposes to use little brown bats as a surrogate for estimating potential take. The use of little brown bats as a surrogate species is supported by the following best available information.

- Indiana bat behavior and ecology are more similar to little brown bats—which is commonly recorded with Indiana bat— than other *Myotis*, and little brown bat has been recorded as fatalities at wind turbines. In addition, Indiana bat was not described as a distinct species until 1928. Prior to that time, it was not distinguished from the little brown bat due to morphological characteristics (USFWS 2007).

- Indiana bat fatalities at wind turbines are a rare event. Of over 3,000 bat fatalities being recorded at wind projects within the range of Indiana bat, three Indiana bat fatalities have been recorded (Johnson et al. 2010; Good et al. 2011). Conversely, data exist concerning interactions of wind turbines with little brown bats. Using these data, an estimate of potential impacts for these species at the Project can be derived.

- Indiana bats could have similar risk of take from turbines as little brown bats. While most evidence from monitoring studies suggests that risk is unequal across species, the evidence is not as clear within genera (e.g., *Myotis*). Characteristics that may be related to risk of collision or barotrauma such as species behavior, habitat, morphology, etc., are likely more similar within genera than across genera.

- Little brown bats are more abundant than Indiana bats, and thus there are sufficient wind farm fatality data from which to model take.

There are known uncertainties with using little brown bats as a surrogate species for estimating take of Indiana bats, as listed below.

- The risk of being killed by a wind turbine is the same for an Indiana bats as it is for a little brown bat. While most evidence from monitoring studies suggests that risk is unequal across species, the similarities between little brown bat and Indiana bat, in terms of morphology, behavior, and ecology, suggests this may be true (*but see* Arnett *et al.* 2008; Johnson 2005).

- Risk to Indiana bats is equal across individuals. That is, risk to individuals is independent of age and sex. There is some suggestion that male bats are at a higher risk than females; however, there is not enough data currently available to confirm this observation, and in particular for *Myotis* species (NWCC 2010; Arnett *et al.* 2008).

Despite these limitations, little brown bats represent the best surrogate for the reasons described above. Using little brown bats as a surrogate for the purposes of estimating take was determined in consultation with the USFWS.

Estimates from post-construction fatality monitoring studies conducted at wind-energy facilities in the eastern U.S. within the range of the Indiana bat vary from approximately eight to 64 bats casualties per turbine per year (Table 4.1)[2]. Overall, approximately 74% of bat casualties discovered at these facilities were either hoary, eastern red, or silver-haired bats; with only 8.8% being *Myotis* species (Table 4.2).

[2] Note: these studies and in Table 4.3 are the best available data related to the impacts from wind projects in the eastern U.S. in the range of Indiana bats and Appalachian region. Methods and study periods for each project varied but the overall objectives of the studies were very similar and these studies constitute the available relevant data as well as provide a range of reasonable potential impacts. The reader should reference each individual technical report for discussion of study limitations, methods, and analysis.

Table 4.1 Summary of post-construction fatality monitoring studies conducted at wind-energy facilities in the eastern U.S. within the range of the Indiana Bat.

Project Name, State	No. of Turbines	Estimated # bats/turbine/ yr	Confidence intervals	StudyYear	Reference
Buffalo Mountain, TN	3	20.8	19.5-22.1[5]	2000-2003	Fielder 2004
Buffalo Mountain, TN	18	63.9	nr	2005	Fielder *et al*. 2007
Mountaineer, WV	44	47.5	31.8-91.6[5]	2003	Kerns &Kerlinger 2004
Mountaineer, WV	44	37.7[1]	31.2-45.1[5]	2004	Arnett *et al*. 2005
Myersdale, PA	20	25.1[1]	20.1-32.7[5]	2004	Arnett *et al*. 2005
Maple Ridge, NY	120	24.5	14.3-34.7	2006	Jain *et al*. 2007
Maple Ridge, NY	195	15.5	14.1-17.0	2007	Jain *et al*. 2008
Maple Ridge, NY	195	8.2	7.4-9.0	2008	Jain *et al*. 2009
Pennsylvania, PA	10	30.1	28.1-33.4[6]	2007	Capouillez&Librandi-Mumma 2008
Casselman, PA	23	32.2	20.8-51.4	2008	Arnett *et al*. 2009a
Mount Storm, WV	82	24.2[3]	17.1-33.1	2008	Young *et al*. 2009a
Mount Storm, WV	132	28.6[4]	18.7-40.5	2009	Young *et al*. 2009b, 2010
Average		**29.9**			

[1] estimate for the 6-week study period;[2] estimate based on simulated searcher efficiency; [3] estimate for the 12-week study period;[4] estimate based on combination of spring and fall results; [5] reported as 90% CI; [6] reported as 99% CI; nr = not reported by authors.

Table 4.2 Number and percentage of bat species found as casualties during post-construction fatality monitoring studies conducted at wind-energy facilities in the eastern U.S. within the range of the Indiana Bat.

Species	**Buffalo Mountain, TN**		**Mountaineer, WV**		**Mount Storm, WV**		**Myersdale, PA**		**Maple Ridge, NY**		**PGC, PA**		**Casselman, PA**		**TOTAL**	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	**n**	**%**
Hoary Bat	44	12.1	244	25.9	305	32.6	138	46.2	337	46.8	61	28.9	74	29.8	**1,203**	**32.4**
Eastern Red Bat	222	61.2	312	33.2	327	34.9	82	27.4	83	11.5	67	31.8	41	16.5	**1,134**	**30.5**
Silver-haired Bat	20	5.51	52	5.53	107	11.4	18	6.02	126	17.5	30	14.2	64	25.8	**417**	**11.2**
Tri-colored Bat	71	19.6	199	21.1	91	9.7	23	7.69	-	-	33	15.6	27	10.9	**444**	**11.9**
Little Brown Bat	-	-	107	11.4	56	6.0	9	3.01	106	14.7	10	4.74	32	12.9	**320**	**8.6**
Big Brown Bat	3	0.83	15	1.59	36	3.9	18	6.02	44	6.11	10	4.74	7	2.8	**133**	**3.6**
N Long-eared Bat	-	-	6	0.64	1	0.1	2	0.67	-	-	-	-	-	-	**9**	**0.2**
Seminole Bat	2	0.55	-	-	2	0.2	-	-	-	-	-	-	2	0.8	**6**	**0.2**
Unidentified bat	1	0.28	6	0.64	10	1.1	9	3.01	24	3.33	-	-	1	0.4	**51**	**1.4**
Total	**363**	**100**	**941**	**100**	**935**	**100**	**299**	**100**	**720**	**100**	**211**	**100**	**248**	**100**	**3,717**	**100**

Calculating Potential Take

Using little brown bat as a surrogate, the potential take of Indiana bats is estimated as follows:

1. Based on the range of bat fatality estimates at monitored wind-energy facilities within 200 miles (320 km) of the Project, it is assumed that between 24 and 48 bat fatalities will occur at the Project per turbine per year (Table 4.3).

2. Based on this range of fatalities per turbine, between 672 and 1,344 bat fatalities could occur per year from the 28 turbine project. This analysis bases the potential mortality on a per turbine basis under the assumption that the individual turbine is the risk factor and each turbine present sequal risk independent of characteristics such as hub height, rotor-swept area, or power output.[3]

Table 4.3 Results of post-construction wind-energy facility monitoring studies within 200 miles (320 km) of the Criterion Wind Project.[4]

Project [state]	No. of Turbines	Bats /turbine/yr	90% CI	Study Year	Reference
Mountaineer [WV]	44	47.5	31.8-91.6	2003	Kerns and Kerlinger 2004
Mountaineer [WV]	44	37.7[1]	31.2-45.1	2004	Arnett *et al*. 2005
Myersdale [PA]	20	25.1[1]	20.1-32.7	2004	Arnett *et al*. 2005
Casselman [PA]	23	32.2	20.8-51.4[4]	2008	Arnett *et al*. 2009a, 2009b
Pennsylvania [PA]	10	30.1	28.1-38.45	2007	Capouillez&Mumma 2008
Mount Storm [WV]	82	24.2[2]	17.1-33.1	2008	Young *et al*. 2009a
Mount Storm [WV]	132	28.6[3]	18.7-40.5	2009	Young *et al*. 2009b, 2010a
Mount Storm [WV]	132	32.3[3]	26.4-43.5	2010	Young *et al*. 2010b, 2011
Total/Average		**32.5**			

[1]estimate for the 6-week study period;[2] estimate for the 12-week study period; [3]estimate based on combination of spring and fall results; [4] reported as 95% CI; [5]reported as 99% CI.

3. Further, if it is assumed that approximately 12.9% of the total bat fatalities would be little brown bats (the highest percentage of little brown bat casualties found at a

[3] To date, no published studies have looked at the relationship of turbine location within a wind-energy facility and bat mortality. The Mountaineer and Myersdale studies (Arnett *et al*. 2005) which studied all turbines within the facilities, did not find any relationship between turbine location and mortality but did note that the one turbine that was not operational during the studies had no bat mortality. At the Mount Storm facility, Young *et al*. (2009, 2010) noted that one turbine accounted for 15-20% of the observed number of bat fatalities, but this study used a sampling approach and it is unknown if there were other non-searched turbines that also had high numbers of bat fatalities.

[4] The location of the Pennsylvania project in Table 4.3 is unknown as it is not reported by Capouillez and Librandi-Mumma (2008), but it is assumed to be within 200 miles of the Project

monitoring study within 200 miles of the Project [Casselman, PA is 12.9%; Table 4.4]); then between 87 and 173 little brown bat fatalities would occur within the Project per year.

4. Finally, based on mist-netting data from WV Department of Natural Resources (C. Stihler, pers. comm., unpublished data), it is assumed that Indiana bat numbers are approximately 0.81% of the little brown bats[5] within the Project and therefore, of the 87-173 little brown bat fatalities estimated to occur per year, on average between 0.70 and 1.40 fatalities[6] would be expected to be Indiana bats (Table 4.5). Over the operation project duration (i.e., 20 years) and using the highest potential annual take estimate, up to 28 Indiana bat fatalities may occur through operations of this project.

Table 4.4 Summary of bat casualties from wind-energy facility monitoring studies within 200 miles (320 km) of the Criterion Wind Project.

Species	**Mountaineer**		**Mount Storm**		**Myersdale**		**Casselman**		**PGC**		**Total**	
	n	%	n	%	n	%	n	%			n	%
Hoary Bat	244	25.9	305	32.6	138	46.2	74	29.8	61	28.9	822	31.2
Eastern Red Bat	312	33.2	327	34.9	82	27.4	41	16.5	67	31.8	829	31.5
Silver-haired Bat	52	5.5	107	11.4	18	6.02	64	25.8	30	14.2	271	10.3
Tri-colored Bat	199	21.1	91	9.7	23	7.69	27	10.9	33	15.6	373	14.2
Little Brown Bat	107	11.4	56	6.0	9	3.01	32	12.9	10	4.74	214	8.1
Big Brown Bat	15	1.59	36	3.8	18	6.02	7	2.8	10	4.74	86	3.3
N. Long-eared Bat	6	0.64	1	0.1	2	0.67	-	-	-	-	9	0.3
Seminole bat	-	-	2	0.2	-	-	2	0.8	-	-	4	0.2
Unidentified Bat	6	0.64	10	1.90	9	3.01	1	0.4	-	-	26	1.0
Total	**941**	**100**	**935**	**100**	**299**	**100**	**248**	**100**	**211**	**100**	**2,634**	**100**

[5] The number of Indiana bats captured during mist-netting surveys in West Virginia conducted at not previously netted locations where the species composition was unknown prior to surveys, was approximately 0.81% of the little brown bats captured (C. Stihler, WVDNR, pers. comm., unpublished data). This ratio was based on approximately 450 mist-netting surveys totaling 3495 little brown and Indiana bat captures over a six year period from 2003 to 2008 (C. Stihler, WVDNR, pers. comm.).

[6] This annual average estimate based on the modeling suggests that there would be between roughly 3 and 6 Indiana bat fatalities for every 4 years of project operation. Take for the ITP will be measured in whole bats and cumulative take of Indiana bats will be tracked over the term of the permit.

Table 4.5 Results of a model estimating take of Indiana Bats within the Criterion Wind Project.

Data Sources[1]	Annual Estimate of Total Bat Mortality	Percent of Fatalities that are Little Brown Bats	Annual Estimate of Little Brown Bat Mortality	Percent that are Indiana Bats	Annual Estimate of Indiana Bat Mortality
Mist-netting, West Virginia Sites	672	12.9%	87	0.81%	0.70
	1,344	12.9%	173	0.81%	1.40

[1] No comparable data was available from Maryland (Dan Feller, MDNR, pers. comm.).

Supporting Evidence for the Take Analysis

The modeling results are sensitive to the ratio of Indiana bats to little brown bats used (see Table 4.5) and the anticipated proportion of little brown bats in the total bat fatalities (12.9%). The model assumes that Indiana bats and little brown bats, the latter being the most common *Myotis*-casualty of WTGs, occur with equal probability within the Project and over time. Existing information suggests that the presence of Indiana bats within the Project is low and variable over time. For example, due to the elevation of the Project (approximately 3,200 ft [975 m]), it is unlikely that any maternity colonies occur within the Project and that Indiana bat presence during the summer would be low. In addition, Indiana bats may be more abundant during migration periods when they are dispersing from the hibernacula in spring and traveling back in the fall, or during the fall swarming season when they are active around caves.

The species composition part of the model is based on results of mist-netting surveys conducted where the species composition was unknown prior to the survey. This type of data is considered to be the least biased in that it is less likely to have inflated the abundance ratio of little brown bats to Indiana bats by either under-estimating the abundance of little brown bats or over-estimating the abundance of Indiana bats (C. Stihler, WVDNR, pers. comm.). Other sources of data were considered for use in the model but dismissed due to the likely propensity to oversample Indiana bats and thus inflate the ratio to little brown bats. For example, surveys conducted at known Indiana bat roosts or cave counts of Indiana bats were not used. Mist-netting surveys targeting known Indiana bat roost sites likely oversample the species when compared to random locations across the landscape. Likewise, the use of State cave survey data to determine species ratios is also biased due to the primary focus of the surveys on caves known to contain endangered species (*i.e.*, Indiana or Virginia big-eared bats). In West Virginia, caves without sensitive species are not routinely counted and portions of caves that are surveyed but do not house these species are also not routinely counted (C. Stihler, WVDNR, pers. comm.). For this reason, little brown bats hibernating in caves that are not known to house Indiana bats are not likely to be included in the population and ratio estimates, and as such overall population estimates are biased low, which in turn increases the ratio for Indiana bats.

This model is further supported by the results of site-specific surveys. No Indiana bats were captured during mist-netting surveys conducted within the Project in early September 2003 and mid-May and late-June 2004 (Gates *et al.* 2006), during which time 19, three, and two little brown bats were caught in the trapping sessions, respectively (Table 3.2). Further, mist-netting surveys conducted in part of the Project in June, July, and August 2010 also captured no Indiana bats, while nine little brown bats were trapped (Table 3.2, Gruver 2011). Of the bat calls recorded in 2003-04 using acoustic detectors (Anabat), 5.6% were determined to be from *Myotis* bats. Acoustic data (Anabat) recorded at the Project in 2010, however, found that approximately 77% of the bat calls recorded were classified as high-frequency calls which include *Myotis* bats. Of the HF calls recorded approximately 0.10% (46 of 43,953 calls) were considered those of Indiana bats (Gruver 2011).

Evidence that Risk to Bats is Unequal across Species and Season. The following results from wind-energy facilities provide additional evidence in support of the assumption that risk to bats is unequal across species and seasons and that, in general, risk to *Myotis* species and other cave dwelling bats (*e.g.,* big brown bat, Townsend's big-eared bat) is lower than for long-distance migrating bats.

- Buffalo Ridge, Minnesota - Acoustic (Anabat) and mist-netting data indicated that there were relatively large breeding populations of bats, such as little brown bat and big brown bat, in close proximity (*i.e.*, within 3.6 km [2.3 miles]) of the wind-energy facility in June and early-July when collision mortality was the lowest (Johnson *et al*. 2003).

- Foote Creek Rim, Wyoming - Of 260 bats captured in mist nets in the vicinity of the wind-energy facility, 81% were bats in the genus *Myotis*, with long-legged myotis (*Myotis volans*) and little brown bats being the most prevalent. Members of this genus, however, comprised only 5% (n=6) of the 123 turbine collision fatalities found during the study (Gruver 2002). Further, hoary bats comprised 88.1% of all casualties discovered but accounted for only 5% of identifiable calls recorded with acoustic detectors (Anabat) at the turbines (Gruver 2002, Young *et al*. 2003).

- Buffalo Mountain, Tennessee - Two *Myotis* species, little brown bats and northern long-eared bats, were detected near the wind-energy facility using acoustic detectors (Anabats) and mist-netting surveys; however, neither species was among the bat fatalities documented at the site (Fielder 2004, Fielder 2007).

- Wisconsin Wind Project – Large populations of big brown bats and *Myotis* bats were reported to be present in the project area; however, only 8.3% (n=6) of the 72 bat carcasses found during post-construction fatality monitoring surveys included these species; the remainder of casualties were hoary, eastern red, or silver-haired bats (Howe *et al*. 2002).

- Recent research at proposed wind-energy facilities is investigating bat activity at different altitudes by elevating acoustic detectors (Anabat) to heights within the turbine rotor swept area. Results from this research show that bat activity in general is lower approximately 50 m above ground level and that fewer high-frequency bat calls (for example those produced by *Myotis* species) are recorded at this height. These data suggest that smaller bats which fall in the high-frequency category tend to forage and fly closer to ground level than larger low-frequency bats, possibly reducing their risk of collision with wind turbines (Arnett *et al*. 2006, Redell *et al*. 2006).

- One of the proposed hypotheses for why bats are killed by wind turbines is the "tall tree hypothesis" which suggests that non-cave hibernating bats gather at the tallest tree in the fall to mate (Cryan 2008). It is suggested that the bats perceive the turbines as the "tallest tree" and congregate and therefore these species are of greater risk than cave-hibernating species.

The above differences between species abundance and fatality data at wind-energy facilities suggest that populations of breeding little brown bats, big brown bats, northern long-eared bats, and Indiana bats near the Project are expected to be at lower risk of collision with turbines than fall migrating bats. This information supports the model as a reasonable and conservative approach for estimating take of Indiana bats and that the annual fatality estimate trending towards zero, but calculated above as between 0.70 and 1.40 Indiana bats, is reasonable.

4.1.3 Estimated Take With Minimization Measures

To minimize potential Indiana bat mortality at the site to the maximum extent practicable, CPP will implement turbine operational changes (see Section 5.2 below). The turbine operational adjustments will include adjusting the blade pitch for the turbines at wind speeds below 5.0 m/s to minimize rotation of the rotor from sunset to sunrise during the period from July 15 to October 15 each year. The best available scientific data to date suggests that this measure will reduce bat mortality due to turbine operations by approximately 44 to 78% (Arnett et al. 2009b; Young et al. 2011) during this period. Assuming overall take of Indiana bat over the 20-year operational life of the turbines (i.e., 28 bats) will be reduced by at least 50% during the fall curtailment period, the estimated take from the project with implementation of the on-site minimization measures is 14 Indiana bats. This is the level of take for which CPP will request coverage in the incidental take permit.

4.2 Impacts of the Taking

Determining the significance of potential take on a population requires an understanding of population demographics and in particular annual survival or mortality rates. The following discussion evaluates impacts at three population levels, the local population (*i.e.* individuals hibernating in counties within 30 miles of the Project), the regional population (*i.e.* within the Appalachian Mountain Recovery Unit), and the national population (the overall range of the species).

Estimates of take determined in the previous section, suggest that 14 Indiana bat fatalities could occur within the 28 turbine wind-energy facility over the project duration. The Draft Indiana Bat Recovery Plan (USFWS 2007) states that during the 2008 population census, hibernacula within 30 miles of the Project housed a total of 13,407 Indiana bats (Table 4.7). Without more recent data at all caves, this figure represents a reasonable estimate of the local Indiana bat population. The loss of 14 bats over the 21-year permit period from this local population represents an approximate 0.004% annual mortality rate (Table 4.7). More recent data is available for the regional and national population estimates (USFWS 2011; 30,308 and 417,185, respectively), and that level of take represents 0.003% and 0.0001% annual mortality on a regional and national scale, respectively (Table 4.7).

Impacts of the take as determined above depend largely on the overall trends in the population (e.g., increasing, decreasing), which are largely unknown over the 21-year term of the permit and are expected to change over time. For example, the latest publicly available information related to Indiana bat populations in the Appalachian Mountain Recovery Unit suggests a population increase; however, with impacts such as WNS occurring, this trend is likely to change over time to a population decrease. In any event, as indicated below, the impact of the take on the population on an annual basis is small and the expected take over the term of the permit (14 Indiana bats) is also small relative to the overall bat population. In terms of recruitment, West Virginia and Pennsylvania experienced a 9% and 16% increase, respectively, in overall Indiana bat populations over the 5-year period between 2005 and 2009; while Virginia experienced a loss of approximately 10% over the same period of time (Table 3.1, USFWS 2011)[7]. Based on total numbers, this represents an average increase of approximately 886 Indiana bats per year. The loss of 14 bats over the 21-year permit period represents approximately 0.075% of this annual recruitment.

Table 4.6 Percent loss of Indiana bat populations based on estimated take of Indiana bats from the Criterion Wind Project.

Population	Definition	Population Estimate	Take Estimate (total)	Population Loss (%/year)	Reference(s)
Local	Counties within 30-mile radius	13,407	14	0.004	USFWS 2007
Regional	Appalachian Mountain Recovery Unit	30,308	14	0.003	USFWS 2011
National	Species range-wide	417,185	14	0.0001	USFWS 2011

An annual 0.004% loss to the local population (Table 4.6) is well within the pre-WNS range of background mortality estimated for Indiana bats (USFWS 2007) and is a small fraction of variation in annual mortality for Indiana bats. Also, the estimated annual loss represents a small fraction of the estimated annual recruitment of Indiana bats at the population scale that is expected to be impacted. At this level of potential impact, the estimated take of Indiana bats due to the Project will not have a measurable effect on the local, statewide, or regional population of Indiana bats. WNS-caused population declines are treated as a changed circumstance and are discussed in Section 8.2. While the death of a reproductive female may be considered to have a greater impact to the overall population than a juvenile male, the expected impact to females is essentially one-half of the estimated overall impact,[8] and as such is still well within the expected background mortality of the population potentially affected.

[7] There is no current information for Maryland populations.
[8] There is some suggestion that male bats are at greater risk than females (NWCC 2010).

5.0 CONSERVATION PLAN

ESA § 10(a)(2)(A)(ii) states that the conservation plan must specify "what steps the applicant will take to minimize and mitigate such impacts.…" Further the HCP Handbook and Five Point Policy addendum issued in 2000 (USFWS and NMFS 1996) provide additional clarification on biological goals and objectives, monitoring, and adaptive management, required components of the HCP. These documents were used in determining the primary approach in developing the following conservation plan.

Based on the estimated take levels for the Project, CPP proposes to provide both on-site minimization and off-site mitigation measures. On-site minimization measures, such as operational curtailment, can reduce the total take of bats and is thus likely to reduce the take of Indiana bats as well. Off-site recovery plan-based actions have the capacity to provide positive benefits to dramatically more Indiana bats than on-site actions designed to further minimize site-specific impacts to the small number of Indiana bats potentially impacted by the Project.

5.1 Biological Goals and Objectives

The primary biological goals of this HCP are to minimize potential take of Indiana bats through on-site minimization measures and to provide habitat conservation measures for Indiana bats to offset any unavoidable impacts to the species during operations of the Project. Available scientific information indicates that the potential take of Indiana bats within the Project as a result of turbine operations could be up to 14 bats over the term of the ITP. However, our understanding of the effects of wind turbines on bats is evolving rapidly. There is current uncertainty and new information is being developed annually. This HCP therefore will include an adaptive management approach which allows response to monitoring results to develop ways to minimize take of Indiana Bats as efficiently and effectively as possible.

As described in the Five Point Policy, "Biological goals and objectives are inherent to the HCP process and as such explicit goals and objectives clarify the purpose and direction of the HCP's operating conservation program. They create parameters and benchmarks for developing conservation measures, provide the rationale behind the HCP's terms and conditions, promote an effective monitoring program, and, where appropriate, help determine the focus of an adaptive management strategy." The biological goals are not necessarily equivalent to the range-wide recovery goals but should support the recovery goals and conservation of the species.

To meet these goals, CPP intends to implement (1) on-site turbine operational changes during the period when bats are at greatest risk of collision with turbines, (2) a monitoring plan to further evaluate the level of Indiana bat take associated with the project, and (3) an adaptive management strategy to evaluate and implement further measures to reduce take if monitoring shows that the level of authorized take will be exceeded over the term of the permit..

5.2 Measures to Avoid and Minimize Take

The primary on-site avoidance and minimization measures for the HCP include turbine operational adjustments, project maintenance procedures, and decommissioning measures.

The turbine operational adjustments will include adjusting the turbine blade pitch[9] at wind speeds below 5.0 m/s to minimize rotation of the rotor from sunset to sunrise during the period from July 15 to October 15 each year. This is the time period that the majority of bat fatalities occur (Arnett et al. 2008). Feathering of the turbine blades will occur by changing the pitch of the blade to have the effect of reducing the rotor rotation to approximately 1 rpm or less at wind speeds of 5.0 m/s. Adjusting the cut-in speed of turbines and feathering turbine blades have been shown to reduce impacts to bats by reducing rotor speeds during periods of low wind speeds (see Young et al. 2011, Arnett et al. 2010). Many studies have shown that bat mortality increases with decreasing wind speed (see Section 4.0 above).

On-site avoidance and minimization efforts during operations include reducing the habitat-attractiveness of areas in close proximity to the turbines by redesigning the storm water management system. The number of onsite retention ponds was reduced from 70 to four reducing the number of temporary and permanent water sources under the turbines and thereby reducing the risk to bats from exposure to the turbines.

While decommissioning is not likely to affect Indiana bat (see Section 2.2.3), decommissioning of the project minimizes long term impacts (when compared with re-commissioning the project) by removing turbines from the site and restoring the site to natural vegetation communities. Decommissioning activities will occur during daytime periods minimizing the potential for creating hazards to active bats.

In the event that trees will need to be removed during normal maintenance or decommissioning activities because they present a hazard or preclude normal project operations, CPP will make every effort to schedule the removal prior to April 1 or after November 15 of any given year. In emergency situations where removal of trees is to occur between April 1 and November 15, CPP will coordinate the tree removal with USFWS as practicable. In non-emergency situations, CPP will conduct a visual survey between sunset and ½ hour after sunset to determine if the hazard tree may be a roost tree for bats.

5.3 Measures to Mitigate the Impact of the Taking

ESA § 10(a)(2)(A)(ii) requires that the HCP specify "what steps the applicant will take to minimize and mitigate (the impact of the taking)." The estimated level of Indiana bat take from the Project is 14 Indiana bats over the 21-year project duration. Although this level of take is not likely to have a measurable effect on Indiana bats at the current local, regional, or nationwide populations, other impacts such as white nose syndrome (WNS) could reduce Indiana bat population levels, thereby altering the potential impact of the estimated take level on the species. WNS-caused population declines are treated as a changed circumstance and are discussed in

[9] Feathering turbine blades is the act of changing the pitch of the blade to reduce lift generated by wind and minimize the turbine rotor speed.

Section 8.0. Because the estimated take level for the Project is low, additional on-site operational curtailment measures will not realize a large conservation benefit for Indiana bats.

In order to provide maximal conservation benefit to the Indiana bat, an effective off-site mitigation program will be implemented (in conjunction with the on-site minimization efforts) to offset take impacts to the species. Conservation and mitigation efforts that are based on regional recovery strategies, for example those articulated in the Indiana Bat Draft Recovery Plan (USFWS 2007), can catalyze recovery plan objectives in ways that are impossible with narrow, site-specific efforts.

Specifically, the Draft Recovery Plan includes detailed, prioritized proposed actions based on four broad components: hibernacula-related recovery actions; conservation and management of summer habitat to maximize survival and fecundity; planning and conduct of research essential for the species' recovery; and development of public education and outreach. Priority 1 actions are those that "must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future," while Priority 2 actions are those "that must be taken to prevent a significant decline in species population/habitat quality or some other significant negative impact short of extinction." All of the recovery plan's Priority 1 actions and all but three of the Priority 2 actions are focused on hibernacula-related recovery actions and species-related research, as follows:

Hibernacula-related recovery actions

The highest priority hibernacula-related recovery actions include:

- Development of template hibernacula management plans (HMP) for the highest priority Indiana bat hibernacula;
- Implementation of HMPs at publicly-owned high-priority hibernacula;
- Implementation of HMPs at privately-owned high-priority hibernacula where landowner cooperation is obtained;
- Survey extant populations at high-priority hibernacula every two years;
- Purchase and/or conserve, through long-term agreements, areas surrounding high-priority hibernacula; and
- Research, develop, and implement cave/mine restoration and protection.

Species-related research actions

The highest priority species-related research actions include:

- Development of population dynamics models;
- Assessment of habitat requirements for maternity colonies;
- Estimation of suitable summer habitat; and
- Development of winter bat survey protocols.

These comprehensive, prioritized actions are those that the USFWS has identified as most important and efficacious to the recovery of the Indiana bat.

5.3.1 Off-Site Conservation Measures

CPP will provide funding for an off-site Indiana bat habitat conservation project designed to mitigate potential incidental take of Indiana bat. The overall intent of this conservation measure is to fund either a hibernacula acquisition or hibernacula gating project that meets the following criteria dependent on the type of project:

Hibernacula Acquisition Project Criteria

1. The project must be a P1, P2, P3, or P4 hibernacula cave that is known to support more Indiana bats than are anticipated to be impacted by the project.

2. In addition to the cave itself, a minimum of 0.25-mile buffer around each cave entrance for the hibernaculum must be protected, which equals approximately 126 to 160 acres, per hibernaculum (assuming, based upon natural features, either circular or rectangular protection around one opening as the central point). For multiple entrance hibernacula, the 0.25 miles can overlap and the protection would be for the area within the outer perimeter of the combined buffers. The actual buffer area must be custom determined on a site by site basis, but should be sufficient to adequately protect the integrity of the entrance and hibernaculum passages from disturbances that would modify temperature and humidity regimes or introduce contaminants into the cave. Depending on the context of the surrounding landscape, larger buffers may be warranted to remove threats to roosting and foraging habitat from logging, urban development, mining, road construction, and other activities.

3. Cave must have threats analysis conducted indicating that surrounding land management practices may adversely affect bats in the cave. Removal of such threats will help to ensure that bats in the cave survive, and that there is an adequate buffer of habitat such that bats leaving the cave do not have to travel far to find abundant roosting and foraging habitat.

4. Cave must have a non-federal landowner (public or private) that is willing to sell the property and/or a protective easement.

5. Focus should be on hibernacula that are not already in public ownership or have no perpetual protective easements in place.

6. If human activity offers a threat to bats in the cave, then cave entrances must be gated in conjunction with the easement or land acquisition.

7. New land owner or easement holder must be willing to protect and maintain the hibernacula in perpetuity so that it continues to serve as a hibernacula for bats

8. Easement or land acquisition must account for all encumbrances (*e.g.*, utility easements, mineral rights, etc.). FWS will need to evaluate the parcel to ensure any encumbrances do not defeat the purpose of the acquisition.

Hibernacula Gating Project Criteria

1. Must be a P1, P2, P3, or P4 hibernacula cave that is known to support more Indiana bats than are anticipated to be impacted by the project.

2. Cave must have threats analysis conducted indicating that human activity presents a threat to bats in the cave.

3. Cave must have a landowner (public or private) that is willing to have the project implemented and can ensure implementation of the gate maintenance plan. USFWS, or third party, should have future access to the site to monitor bat populations and/or use of the cave.

4. If there are multiple cave entrances for a hibernaculum, each entrance should be gated.

5.3.2 Mitigation Project Implementation

CPP intends to provide funding for implementation of a hibernacula acquisition or gating project within the Appalachian Mountain Recovery Unit (Appendix C). Currently, CPP is evaluating the feasibility of several potential cave projects in collaboration with Bat Conservation International (BCI) (Table 5.1). These projects have been identified as feasible projects which would provide high conservation value to Indiana bats as well as other bat species utilizing these caves. The objective of the hibernacula protection project would be to protect the cave and a buffer around the cave through either purchase or conservation easement for the life of the permit, or a project to remove or minimize threats to bats in the cave, such as winter time human disturbance through cave gating. These types of cave protection measures have been shown to improve survivorship of bats within the cave resulting in increases in population over time. Any of the projects under consideration would more than offset the impacts of the taking from the loss of 14 Indiana bats due to the operation of the Criterion project.

Table 5.1 Hibernacula acquisition or gating projects within the Appalachian Mountain Indiana Bat Recovery Unit.

Name	Location	Indiana bat Estimate	Description
Hipple Cave	Bedford County, Pennsylvania	300	P3 cave with two entrances on private land, believed to be an ex-show cave
Kelley Ridge Cave	Blount County, Tennessee	360	P3 cave with one entrance on private land (may have several owners)
Clarks Cave	Bath County, Virginia	49	P4 cave with five entrances on private land, popular recreational cave
Piercys Cave	Greenbrier County, West Virginia	54	P3 cave on private land, the number of entrances is being verified
Fortlick Cave	Randolph County, West Virginia	109	P3 cave with two entrances on private land
Stewart Run Cave	Randolph County, West Virginia	83	P3 cave with two entrances on private land. Cave also contains Virginia Big Eared bats
Izaak Walton Cave	Randolph County, West Virginia	97	P3 cave within Monongahela National Forest but on private land; popular recreational cave; gating project

CPP will select, in coordination and with written concurrence[10] of USFWS, the mitigation project based on potential conservation value to Indiana bat and for the population potentially impacted by the Project, in this case within the Appalachian Mountain population. The selected project will also be based on feasibility as determined during the evaluation of the potential mitigation projects and ability to implement the project within 24 months of issuance of the ITP. Currently, the habitat conservation projects listed in Table 5.1 are considered feasible options that would meet the objective of mitigating the potential impact of loss of 14 Indiana bats over the 21-year term of the permit. BCI in collaboration with CPP is continuing to evaluate the feasibility of the potential mitigation projects (Table 5.1)

CPP will develop a binding contract with BCI and a qualified contractor or entity to implement the project prior to USFWS issuance of the permit. The contractor will be required to implement the project within 24 months of permit issuance. CPP will set aside $176,250 for project implementation in a letter of credit that will be used to satisfy the contract requirements.

[10] CPP requests that the USFWS is committed to providing written response within 60 calendar days of concurrence with the proposed mitigation project. In the event that circumstances do not allow a response within 60 days of receipt of the proposal, then the time period to implement the project will be extended by the amount of time beyond 60 days necessary for the concurrence to be provided.

If CPP selects a hibernacula acquisition project, the following provisions will be incorporated since the grantee or holder of the protected property interest has not yet been identified and it was not possible to develop a draft conveyance or conservation easement. Also, State laws vary with respect to the structure, purpose, content and enforceability of easements and real property conveyances. Additionally, land protection necessarily involves multiple parties.

The following mandatory provisions will apply to any acquisition:

1. Standard Recitals that identify the parties, applicable provisions of state law, description of property, intent to bind parties, etc.
2. Additional Recitals describing: the relationship between the conveyance to the HCP, and ITP, and referencing the dates each is executed; the authority and role of the Service; the HCP species that is subject of the conveyance and date it is listed.
3. The stated purpose of the easement or deed transfer, mainly the conservation of the HCP species and its habitat. Secondary purposes to allow the restoration or maintenance of a habitat type or other species may be permitted so long as they do not interfere with or diminish the values established for the Covered Species.
4. Processes for enforcement including damages, restoration, or other remedies at law.
5. Third party beneficiary rights for the Service to access the property and to enforce the terms of the conveyance.
6. A requirement that the conveyance be recorded in the land records of the county, parish or other jurisdiction in which the land is located.
7. That restrictions or easement terms are binding in perpetuity, regardless of species listing status.
8. A number of other provisions required by the Service, such as those dealing with: assignment, transfer, extinguishment, modification of the conveyance; interpretation and severability; and government permits and eminent domain.
9. All real property conveyances must include prohibitions on following uses:

   Industrial use
   New residential construction
   Commercial use
   Agricultural use
   Vegetative clearing
   Subdivision
   Utilities (except for existing encumbrances)
   Littering or dumping
   Burning of waste or open fires
   Disposal of hazardous waste
   Grading, mineral use, excavation, dredging
   Placement of spoils
   Development rights extinguished

10. All real property conveyances must include prohibitions on the following uses, which may be tailored to maintain or restore the values of the conservation area, or a species' needs:

    Signage
    Construction
    Fencing
    Hunting/Trapping/Collection
    Pesticide, Herbicide
    Pets
    Mechanized vehicles/equipment

11. The grantor of the real property interest may also want to retain Reserved Uses, so long as they do not interfere with the purpose for which the conservation interest is acquired. The following reserved uses may be acceptable if properly conditioned: Passive Recreational Use, Educational Use, and Selective Vegetative Management.

USFWS template easement language is included as Appendix E.

5.4 Relation of Mitigation to Level of Potential Take

According to USFWS guidance, mitigation should be scientifically and rationally related to the level of the take and the impact of the taking; and is commensurate with the impact of the taking. Based on the model outlined in Section 4.1.2 in conjunction with the anticipated benefits of on-site operational curtailment, it is determined that the potential take by the Project is 14 Indiana bats over the projected 21-year project duration. That level of take is low and will be completely offset when on-site minimization measures are combined with the off-site recovery plan based mitigation project.

CPP estimates that the on-site minimization measures of adjusting the turbine blade pitch at wind speeds less than 5.0 m/s to minimize rotor rotation at night from July 15 to October 15 will likely result in greater than 50% reduction in bat mortality during this period at the site. Based on evaluation of the costs associated with the potential mitigation projects (Table 5.1), CPP estimates that $150,000 which would cover the highest estimated project costs (see Section 6.0 below) and will offset the estimated loss of 14 Indiana bats because the specific projects as identified that would be implemented would benefit and enhance the survival of potentially hundreds of Indiana bats and if meeting recovery plan objectives, would be in perpetuity. However, it is recognized that the cost of a project that achieves the biological goals could vary from the estimate based on unknown factors. If a project is implemented at a lower cost, the unused portion of the fund will be refunded to CPP. If additional funds are required to implement the selected project, CPP will add an additional amount as necessary to the fund. The projects for which CPP is evaluating for mitigation (Table 5.1) have a minimum population of approximately 49 bats. The mitigation project will increase over-winter survival and likely maintain the reproductive potential of the population being protected. Therefore, any of these projects, once implemented, would more than mitigate the impacts of the potential taking of 14 Indiana bats over the life of the project.

5.5 Monitoring and Reporting Program

The overall goal of monitoring is to provide needed information to help make informed decisions about project operations for meeting the conservation objectives, and if needed, allow for further protection of the Indiana bat based on the monitoring study results and the current state of the knowledge regarding wind turbine operations and impacts on bat species. The primary objective of the project operations monitoring is to verify that the minimization measures (the turbine operational adjustments) are effective at minimizing take of Indiana bat and therefore show compliance with the ITP.

The monitoring plan will provide information necessary to assess ITP compliance, project impacts, and verify progress towards the biological goals and objectives (Appendix D). There are two types of monitoring that should be addressed: compliance monitoring and effectiveness monitoring. Monitoring results and compliance with the terms of the HCP and ITP will be reported annually to the USFWS and the MDNR Natural Heritage Program.

CPP has conducted one year of intensive monitoring, using methods recommended for wind-energy facilities (e.g. WTGAC 2010), during the first year of full project operations (2011). The monitoring occurred during the period April 1 through November 15 which is the period when bats could potentially be active in the project. This first year of monitoring provides baseline results regarding bird and bat impacts from the project and results will be available in early 2012.

During the first two years post-ITP issuance, monitoring studies will be conducted within the Project. Overall, with the first year of pre-ITP monitoring, a total of three years of post-construction monitoring will be conducted at the project. The goal of the first year of monitoring (pre-ITP) was to estimate mortality rates of bats and birds including an estimate of Indiana bat mortality, demonstrate compliance with the authorized take, and allow an evaluation of the effectiveness of the curtailment plan at reducing overall bat mortality[11] (and presumably Indiana bat mortality as well). While several studies and monitoring reports have documented the reduction in overall bat mortality with turbine curtailment at low wind speeds (Arnett et al. 2011, Baerwald et al 2009, Young et al 2011), comparison of year 1 results to those in years 2 and 3 will provide an estimate of bat mortality reduction from curtailment at the Criterion site, and thus demonstrate the effectiveness of the minimization measures. The monitoring report for the Project will also include a comparison of the effectiveness of the turbine operation changes in reducing bat (and bird) mortality (see Appendix D).

[11] Currently, the state of the science regarding turbine curtailment studies has shown this measure to be highly effective at reducing all bat mortality. Generally, however, bat mortality at wind projects is composed primarily of migratory tree bats (see Tables 4.2 and 4.4). The ability to distinguish the effectiveness of turbine curtailment measures on other species of bats, which comprise much less of the overall bat mortality, is difficult. It is however, a valid assumption that turbine curtailment is beneficial to all bat species because the act of controlling the rotation of turbine rotors in low wind speeds reduces risk posed by turbine blades by minimizing their speed. Under this assumption it is valid to use all bat mortality as a surrogate measure of the effectiveness of the proposed turbine operational curtailment (the minimization measures) in reducing potential mortality of Indiana bat and little brown bats (which serve as a surrogate in the Indiana bat take calculations for this project), and therefore, compliance with the ITP through achieving a 50% reduction in bat mortality during the fall curtailment period.

Following the first three years of monitoring (two years post ITP issuance), CPP will implement follow-up compliance monitoring during years 8, 13, and 18 of the permit. The objective of the follow-up monitoring is to evaluate compliance with the ITP by ensuring that the total bat mortality is within the range evaluated in the HCP and consistent with results from the monitoring conducted in the 2 years post ITP. Because Indiana bats are rare and difficult to monitor, total bat mortality will be used as a surrogate for the likely take of Indiana bats. Based on current information, CPP anticipates that the minimum monitoring effort in these years will involve weekly surveys at a minimum of one-half of the turbines (14) and will be conducted between April 1 and November 15. This level of effort is likely sufficient to determine the level of all bat mortality occurring at the site; however, following analysis of the first year of monitoring data from 2011, a power analysis will be conducted using site specific data to determine the sample size and search frequency needed to adequately compare all bat mortality from one year to the next. In addition, an evaluation will be made each monitoring year utilizing all previous monitoring study results to ensure that the study design for that monitoring year is sufficient to meet the objectives. If new information becomes available to suggest otherwise, improved ways of assessing Indiana bat mortality directly or better ways of assessing bat mortality as a surrogate measure for Indiana bat mortality, CPP will implement those methods in consultation with the USFWS and MDNR.

In addition to the Project monitoring as described, CPP has established an in-house Operating Procedure for Incidental Bird and Bat Casualties that has been implemented at the Project for commercial operations (Appendix F). This Operating Procedure governs the appropriate treatment of bird and bat casualties discovered at the Project outside of formal monitoring studies. Turbine operation and maintenance staff are on-site every day and may find bird and bat fatalities. Providing a systematic way of collecting and reporting these casualties provides a more complete assessment of all impacts. In the event an Indiana bat is found during the intensive monitoring or during the Operating Procedure for incidental finds, the location and condition of the carcass in the field will be documented and the specimen will be tagged with this identifying information and stored in a secure freezer onsite. The incident will be reported to USFWS within 24 hours of positive identification of the casualty. The specimen will be provided to USFWS or their designee by CPP upon receipt of instructions.

Table 5.2 Criterion Wind Project ITP monitoring program.

Monitoring Type	Objective	Season	Frequency
On-site Monitoring	Assess take of Indiana bats		
Year 1	Assess take of Indiana bats and determine total bat mortality and seasonality of bat fatalities.	April 1 - Nov 15, 2011	Daily searches of all 28 turbines
Years 2 and 3	Assess take of Indiana bats and total bat mortality with curtailment plan	April 1 – Nov 15, 2012 and 2013	Weekly surveys of 14 turbines
Incidental Monitoring of Bird and Bat Casualties	To amplify the monitoring and provide a more complete assessment of project related casualties.	All year	Coincident with routine operations and maintenance activities
Follow-up Monitoring (Years 8, 13, 18)	To insure that total bat mortality with curtailment has not increased and remains within expected levels	April 1 – Nov 15	Weekly surveys of 14 turbines, unless new information suggests a better approach.
Adaptive Management Monitoring	If the monitoring or the Follow-up Monitoring ever suggests that take of Indiana bats is occurring at a rate that might result in exceeding the ITP limit, CPP will implement additional operational changes to reduce that rate and then implement an additional year of monitoring to demonstrate effectiveness of the additional measures.	To be determined based on previous information. But April 1 – Nov 15 is the expected study period.	To be determined, but this monitoring is expected to be more intensive than the follow-up monitoring described above.

For the first year of operations, CPP conducted monitoring studies from April 1 to November 15, 2011 that included casualty searches of all 28 turbines on a daily basis (Table 5.2). This rigorous design allows the monitoring study to address multiple objectives and provide information necessary for post-ITP monitoring (years 2 and 3). In addition to assessing the estimated level of take of Indiana bat, the study design will allow investigation of circumstances such as weather conditions around bat (and bird) mortality and provide baseline data for comparison with the effects of changes in turbine operations on bat (and bird) mortality. The first year results will provide information on the level of Indiana bat take, the rate of carcass removal from the site, the percent of casualties found by searchers, and the weather conditions when bat mortality is the highest.

The primary objective for the monitoring over the two years post-ITP issuance is to further assess the level of bat mortality from operation of the Project under the turbine operational adjustments described above (on-site minimization measures). The first year of monitoring post-ITP issuance will allow evaluation of the effectiveness of restricting turbine operations during low-wind periods in reducing bat mortality. This information can be used to inform the monitoring study design for subsequent years for variables such as the study timing, the search interval, and the timing and conditions of turbine operation changes for reducing bat mortality to inform the adaptive management strategy if and when it is triggered. At a minimum, the additional years of monitoring (including years 8, 13, and 18) will be at a level sufficient to determine the level of all bat mortality to demonstrate the project is compliant with the original model estimates for take and thus the authorized level of take in the ITP.

5.6 Adaptive Management Program

Adaptive management is an integrated method for addressing uncertainty in natural resource management. Broadly defined it is a method for examining alternative strategies for meeting measurable biological goals and objectives, and then, if necessary, adjusting future conservation management actions according to what is learned. Specifically, for projects that may pose a risk to a species, but at the time the ITP is issued there are significant data/information gaps that make identification of the risk and impacts uncertain, an adaptive management strategy should be applied to address those uncertainties.

As described above (Section 5.5), the Project will be monitored for three years (two years post-ITP) to assess the level of take of Indiana Bats and evaluate the effectiveness of turbine operational changes in reducing bat (and bird) mortality. While there is confidence that curtailment will reduce total bat mortality, based on results of other studies (Arnett et al. 2011, Baerwald et al 2009), the effectiveness of this minimization strategy will be evaluated at the project site. CPP will consult with the USFWS to interpret the results of the monitoring surveys, evaluate new available data, and adjust on-site minimization strategies, if needed, to insure the level of authorized take is not exceeded over the term of the permit. Following completion of each year of monitoring, the results of the studies in relation to the goals of the HCP, and compliance with the terms of the HCP and ITP will be evaluated.

As described in the monitoring plan (Appendix D), the level of bat mortality will be estimated for the project by correcting the observed number of fatalities for potential biases associated with the monitoring study (i.e., searcher efficiency, carcass removal, and carcass distribution) to account for those fatalities that were not recovered. Using the estimated all bat mortality from the first year, as determined through the corrections, provides a reasonable comparison of the results from other regional monitoring studies. In addition, comparison of the pre-ITP monitoring data to the two years of post-ITP monitoring data will evaluate the effectiveness of turbine operation changes in reducing bat (and bird) mortality and determining potential take of Indiana bat through the surrogate species process described in Chapter 4.0.

On-site Monitoring (one year pre-ITP and two years post ITP issuance): estimates of the total Indiana bat take will be made (1) based on the actual number of recovered Indiana bats adjusted for bias correction factors (e.g., searcher efficiency, carcass removal) as described in the monitoring plan (Appendix D) and (2) based on the number of little brown bat fatalities (the surrogate species) adjusted for bias correction factors (e.g., searcher efficiency, carcass removal). Comparison of these two different estimates of take with the authorized take averaged over the permit period (14 bats over 20 operational years equates to a rate of take of 0.70) will be made to determine the need for an adaptive management response. If the average estimated Indiana bat take over the three year evaluation period is less than 0.70, no additional on-site minimization measures (beyond those described in Section 5.0) will be implemented. This will show that the cumulative level of take is on pace to be 14 Indiana bats or less over the project duration. Mitigation measures will continue to focus on off-site recovery plan based conservation measures, as described above. If the average estimated take exceeds 0.70 Indiana bats over the three year evaluation period, CPP will implement additional on-site minimization measures (e.g., turbine operation changes) to avoid/minimize the level of Indiana bat take at the site. Exceeding this trigger would suggest the cumulative level of take is on pace to exceed the 14 Indiana bats authorized over the project duration, and thus require additional minimization measures. The level and type of additional on-site minimization measures will be developed in consultation with the USFWS and based on results of the monitoring studies, and the most current data or other study results available at the time. In addition, the project would be monitored for at least an additional year (described as adaptive management monitoring in Table 5.2 above) to verify the effectiveness of the new turbine operational changes and that take of Indiana bats will remain below the 14 authorized by the ITP over the course of the project.

Follow-up Monitoring: Estimates of the total Indiana bat take will be made (1) based on the actual take of recovered Indiana bats adjusted for bias correction factors (e.g., searcher efficiency, carcass removal) as described in the monitoring plan (Appendix D) and (2) based on the number of all bat fatalities adjusted for bias correction factors (e.g., searcher efficiency, carcass removal). In the event that take is exceeded, the same adaptive management response as described above will be triggered in order to reduce the rate of Indiana bat mortality. Additionally, this take estimate will be applied to each of the prior un-monitored operational years and then compiled into a cumulative take estimate for the project.

6.0 FUNDING

ESA § 10(a)(2)(B)(iii) provides that the USFWS shall issue an ITP if, among other things, it finds that "the applicant will ensure that adequate funding for the plan will be provided." CPP will ensure that adequate funding for the plan will be provided in two ways. First, CPP plans to fund various aspects of the plan—as detailed in the following subsections—through the expenditure of a portion of its own revenue. CPP expects that it will generate sufficient income over the 20 year term of its Power Purchase Agreement to ensure that costs associated with funding the plan will be provided. Second, CPP will cause a letter of credit in the amount of $1,625,000 to be issued by a rated bank for the benefit of the USFWS. Alternatively, CPP may replace the letter of credit with a performance bond for the benefit of the USFWS in the amount of $1,625,000 that is issued by a rated entity. In either circumstance, CPP will coordinate the language of the funding assurance mechanism in advance with the USFWS. USFWS may draw on all or a portion of such security, to the extent that CPP fails to provide adequate funding for the plan. Through these two approaches, CPP will ensure that adequate funding for the plan will be provided.

6.1 Costs for Implementing the HCP

The primary costs for implementing the HCP include the mitigation project, the project monitoring, and reporting. Other associated costs include general administration and management of the HCP and monitoring, on-site minimization, and mitigation measures (Table 6.1).

Table 6.1 Estimated Costs for Implementing the Criterion HCP.

Budget Item	One-Time Expense	Year 1	Year 2	Years 3-20	20 Year Project Total
Conservation Project	$ 176,250[12]	-	-	-	$ 176,250
Monitoring	-	$ 120,000	$ 120,000	$ 928,800	$1,168,800
Reporting	-	$ 15,000	$ 15,500	$ 115,100	$ 145,600
General Overhead	-	$ 5,000	$ 5,150	$ 124,200	$ 134,350
				Total	$1,625,000

[12] $150,000 project costs plus overhead for implementing project

7.0 ALTERNATIVES CONSIDERED

ESA § 10(a)(2)(B)(ii) provides that the USFWS shall issue an ITP if, among other things, it finds that "the applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such [incidental] taking." The HCP Handbook (USFWS and NMFS 1996) provides guidance on this requirement as follows:

> This finding typically requires consideration of two factors: adequacy of the minimization and mitigation program, and whether it is the maximum that can be practically implemented by the applicant. To the extent that the minimization and mitigation program can be demonstrated to provide substantial benefits to the species, less emphasis can be placed on the second factor. However, particularly where the adequacy of the mitigation is a close call, the record must contain some basis to conclude that the proposed program is the maximum that can be reasonably required by that applicant. This may require weighing the costs of implementing additional mitigation, benefits and costs of implementing additional mitigation, the amount of mitigation provided by other applicants in similar situations, and the abilities of that particular applicant. Analysis of the alternatives that would require additional mitigation in the HCP and NEPA analysis, including the costs to the applicant is often essential in helping the Services make the required finding.

See HCP Handbook at 7-3–7-4. In its section on mitigation programs and standards, the HCP Handbook also states:

> [R]ecovery is nevertheless an important consideration in any HCP effort. This is because, some HCPs may encompass all or much of a species' range and address crucial biological issues; because of the inherent biological significance of such planning areas, a poorly designed HCP could readily trigger the "appreciably reduce" or "jeopardize" standard. Second, many HCPs, even smaller ones, can be said to contribute to recovery to the extent that individually or collectively they provide for dependable conservation actions and long term biological protections. Thus, contribution to recovery is often an integral product of an HCP, but it is not an explicit statutory requirement.
>
> To put this in practical terms, applicants should be encouraged to develop HCPs that produce a net positive effect for the species or *contribute to recovery plan objectives*. The Service should also assess the extent to which an HCP's mitigation program is consistent with recovery plans. In general, conservation plans that are not consistent with recovery plan objectives should be discouraged.

See id. at 3-20. CPP used the above guidance in evaluating and proposing a conservation plan best addresses the issues of "adequacy," "maximum extent," and "practicability" in the section dealing with conservation or mitigation actions.

The three alternatives analyzed in this section are: (1) operation of the Project with an ITP with on-site minimization and off-site mitigation for Indiana bat impacts (preferred action); (2) operation of the Project with an ITP with on-site operational curtailments to avoid or minimize Indiana bat impacts only; and (3) operation of the Project without an ITP and no on-site or off-site avoidance, minimization, or mitigation of Indiana bat impacts ("no action" alternative).

7.1 No Action Alternative: Operation of the Project without an ITP and without On-site or Off-site Avoidance, Minimization, or Mitigation of Indiana Bat Impacts

Under this alternative, CPP would not apply for an ITP and would not implement off-site recovery plan-based mitigation measures nor implement on-site operational curtailment measures if needed as described above. Because the ITP application is for *operations* of the Project, this no action alternative is limited to non-issuance of an ITP by USFWS. And because an ITP is not legally required for either the construction or the operations of the Project, the Project would still be operated but without the important protections of the ITP and without the conservation benefits proposed through funding recovery plan-based mitigation measures.

7.2 Action Alternative 1: Operation of the Project with an ITP with On-site minimization and Off-site Mitigation for Indiana Bat Impacts (Proposed Action)

This alternative is described fully in Sections 1–6 and 8–9 of this document. In summary, this alternative contemplates: (1) the normal commercial operation of the Project for a period of 20 years, with an estimated take level of 0.35 to 0.70 Indiana bats per year; (2) on-site minimization via project monitoring and turbine operational changes that are projected to reduce take by 50% during the fall curtailment period; (3) funding to support recovery-based off-site mitigation; and (4) the use of adaptive management to evaluate whether future additional on-site minimization may be necessary or practicable in avoiding or minimizing unexpected levels of Indiana bat take.

In determining whether to issue an ITP, the Secretary must find, among other things that "the applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking." ESA § 10(a)(2)(B)(ii). Recognizing the flexible nature of this requirement, the USFWS, in its HCP Handbook, recognized that "[m]itigation programs under HCPs and section 10 permits are as varied as the projects they address." HCP Handbook at 3-19. Observing that effective HCPs are inherently project specific and should therefore be developed on a case-by-case basis, the USFWS has explained that "[m]itigation programs should be based on sound biological rationale; they should also be practicable and commensurate with the impacts they address."*Id.*

With these authorities in mind, and considering contributions of on-site and recovery plan-based conservation and mitigation, CPP proposes this alternative is the best approach for meeting the adequacy, maximum extent, and practicability cost considerations for minimizing and mitigating estimated take at the project as follows:

- **Adequacy.** Studies of on-site operational curtailment actions during the season of highest bat mortality have demonstrated reduction in overall bat mortality (Arnett et al. 2011, Baerwald et al. 2009). However, monitoring at Criterion will further confirm this relationship at this site. On-site operational curtailment studies are silent as to the impact of on-site operational curtailment on any one species, specifically on Indiana bats. Those studies support an *implication* of reduced risk, but do not *establish* reduced risk. Accordingly, on-site minimization, which has been shown to reduce all bat mortality, is assumed to have a similar reduction in potential Indiana bat mortality. Off-site mitigation targeted at conservation of a population of Indiana bats will be used to address incidental take that may occur after avoidance and minimization measures are implemented (as assessed through take estimates).

- **Maximum extent.** Recovery plan-based off-site conservation and mitigation actions, in conjunction with the proposed on-site minimization, appear to maximize potential positive benefits to Indiana bats. In the best case at this low-risk site, it may be that operation of the facility may result in no take of Indiana bats over the project lifetime; therefore, any additional on-site operational curtailment would result in no conservation benefit to the species. On the contrary, off-site mitigation through funded conservation measures would result in real benefits to the species, even if no Indiana bats are ever taken at the facility. The off-site mitigation is therefore an important component of meeting the HCP standard of minimizing and mitigating to the maximum extent practicable. The off-site mitigation projects will result in those conservation benefits encouraged by the USFWS in its prioritized Indiana Bat Recovery Plan. CPP consulted with leading bat ecologists and biologists, and all are in agreement in principle that the preferred method of Indiana bat conservation in light of low probability of take at the Criterion site is off-site mitigation.
- **Practicability.** Project monitoring, turbine operation changes, and recovery plan-based conservation and off-site mitigation actions can be practicably implemented. CPP business objectives are to produce renewable energy to fulfill the requirements of their power contract with ODEC. Overall, renewable power generation is a preferred alternative to power generated from fossil fuel emissions due to the large reduction in GHG and other emissions. However, CPP recognizes that wind turbines have the potential to have adverse effects to Indiana bats and birds. This HCP commits CPP to implement avoidance and minimization measures and provide off-site mitigation to more than compensate for the estimated level of take that may still occur. In addition, CPP will implement a balance of monitoring and longer term compliance monitoring in concert with an adaptive management approach to address uncertainty in the minimization measures and initial model assumptions. While implementing the HCP will reduce power production capabilities during a portion of the fall, the balance reached in the HCP between wildlife protection and renewable energy production reflects the maximum practicable extent to which operational minimization can be achieved based on the best available scientific information regarding the best periods of operational curtailment. That is, more curtailment would impracticably reduce renewable power generation, while less curtailment would impracticably reduce wildlife protection.

Accordingly, based on the estimated take levels for the Project, CPP proposes to offer on-site minimization efforts along with funding recovery plan-based off-site mitigation measures to off-set projected take of Indiana bats. Of course, to the extent that monitoring demonstrates that actual take exceeds the estimated take levels, CPP will implement adaptive management techniques, including additional on-site minimization measures, to address these changed circumstances.

7.3 Action Alternative 2: Operation of the Project with an ITP with Complete On-site Operational Curtailment to Avoid or Minimize Indiana Bat Impacts Only; No Off-site recovery –plan based mitigation measures.

This alternative would substitute total on-site operational curtailments (i.e., the turbines are not operating) during times at which Indiana bats may be exposed to risk of collision (specifically sunset to sunrise from April 1 to November 15th each year) for off-site recovery plan-based mitigation measures. This alternative would be the worse-case scenario in terms of lost production of non-polluting electricity and potential conservation benefit to Indiana bat, and the project would not be able to meet the contract availability requirements. As discussed above, because the probability of take of an Indiana bat from the Project is very small (approximately 1 individual per year), these on-site operational curtailment efforts will likely yield only inconsiderable benefits to the species and in the event that there is no take of Indiana bats, would provide zero benefits to the species. Comparing the relative contributions of the statutory provisions relevant to an alternatives analysis and adequacy of mitigation alternatives suggest the following conclusions, as set forth in the preceding subsection:

- **Adequacy.** Complete on-site operational curtailment appears much less adequate than recovery plan-based actions, simply because the recovery plan-based actions have the capacity to provide positive benefits specifically to Indiana bats than minimizing site-specific impacts to a small number of Indiana bats (likely less than 1.40 per year).
- **Maximum extent.** Recovery plan-based conservation and mitigation actions appear to maximize the potential positive benefits to Indiana bats, while complete on-site operational curtailment will do no more than address an already small risk of take.
- **Practicability.** CPP business objectives are to produce renewable energy to fulfill the requirements of their power contract with ODEC. Overall, renewable power generation is a preferred alternative to power generated from fossil fuel emissions due to the large reduction in GHG and other emissions. However, CPP recognizes that wind turbines have the potential to have adverse effects to Indiana bats and birds. This HCP commits CPP to implement avoidance and minimization measures and provide off-site mitigation to more than compensate for the estimated level of take that may still occur. While implementing the HCP will reduce power production capabilities during a portion of the fall, the balance reached in the HCP between wildlife protection and renewable energy production reflects the maximum practicable extent to which operational minimization can be achieved based on the best available scientific information regarding the best periods of operational curtailment. Here, complete avoidance under this alternative would eliminate the risk of take, but would also defeat the important renewable energy generation-related purpose of the project by severely curtailing by some 27% the availability of renewable electricity to meet Renewable Portfolio Standard (RPS) requirements, and by preventing the project from meeting its availability requirements under the Project’s power contract with ODEC. Consequently, complete avoidance under this alternative is impracticable, particularly when compared with the minimal additional benefits to Indiana bats under the alternative.

Accordingly, CPP does not propose to utilize this alternative, preferring maximally-effective, practicable, and relatively more adequate recovery plan-based mitigation measures.

8.0 PLAN IMPLEMENTATION / CHANGED AND UNFORESEEN CIRCUMSTANCES

8.1 Plan Implementation

CPP will implement this HCP pursuant to the ITP, HCP, and IA (Appendix G) terms, seeking additional USFWS approval where necessary. The HCP will be implemented for the duration of the permit, with a minimum of two years of post-ITP monitoring and follow-up compliance monitoring in years 8, 13, 18. Results of each year of surveys will be used to assess the level of take, ensure effectiveness of the minimization measures, and if necessary, trigger the adaptive management process to modify the conservation plan to meet HCP objectives.

CPP will meet with the USFWS at least annually during the first two years and following completion of monitoring in years 8, 13, and 18 to discuss results of the on-site monitoring for bat (and bird) impacts. Additional meetings/conferences may be called by involved parties as necessary to address immediate or perceived concerns. The purpose of the annual meetings will be to evaluate the efficacy of monitoring methods; compare the results of monitoring to the authorized take level; evaluate the success of any minimization/mitigation strategies, if required; and develop recommendations for future research, monitoring and mitigation, again if required. The annual meetings will also provide an opportunity to consider the need for adaptive management measures and/or changes to the monitoring protocol.

8.2 Changed Circumstances

Under HCP guidance, changed circumstances are those circumstances affecting a species or geographic area covered by a HCP that can reasonably be anticipated and that can be planned for. For example, the listing of a new species under the ESA; results of known on-going impacts to the covered species outside the applicant's control; fire or other natural catastrophic events within areas prone to such events. The HCP should discuss measures developed by the applicant to address foreseeable changed circumstances over time, possibly by incorporating adaptive management procedures for covered species within the HCP. To the extent practicable, HCP planners should identify potential changed circumstances in advance and develop specific strategies for dealing with them within the HCP. The intent of addressing changed circumstances early in the process is to provide a means for adjustments to the conservation plan as necessary without an amendment of the HCP/ITP.

The primary biological goals of this HCP are to minimize potential take of Indiana bats through on-site turbine operational adjustment measures and provide habitat conservation measures for Indiana bats to offset any unavoidable impacts to the species during operations of the Project. Available scientific information indicates that the potential take of Indiana bats within the Project as a result of turbine operations will be relatively minor but could be up to 14 bats over the life of the permit. This level of impact may be difficult to detect, therefore CPP will implement on-site minimization efforts along with off-site habitat conservation measures as described in Section 5 of the HCP to offset any unavoidable take of Indiana bats. Given uncertainties about the presence of Indiana bats within the Project and other the potential changes to Indiana bat status, for example population declines due to WNS, CPP believes the following are foreseeable changed circumstances warranting planning consideration:

- Changes in Indiana bat distribution due to climate changes that may influence the species survival and recruitment in previously unsuitable areas. For example, warmer temperatures allowing maternity colonies to be established at higher elevations such as within the Project.
- Population declines or catastrophic population failure due to WNS.
- Listing of additional bat species, such as eastern small-footed myotis (*Myotis leibii*) and northern long-eared myotis (*M. septentrionalis*), due to population declines.

8.2.1 Species Distribution

Changes in species abundance and distribution are not always well understood or easy to predict. In the event that Indiana bat distribution changes, by spatially affected changes such as increased seasonal temperatures that may result in greater localized abundance or the evidence of a maternity colony in close vicinity to the project, the risk of take of Indiana bats could increase over current conditions. CPP will evaluate results from the monitoring during years 8, 13, and 18 and the best available data and information at the time to determine, in coordination with the USFWS, whether there has been a confirmed, significant increase in Indiana bat abundance in the Permit Area.

Trigger:
Confirmed significant increase in Indiana bat abundance in the Permit Area as measured by the best available scientific information, including results from monitoring in the Permit Area during years 8, 13, and 18. In addition, the discovery of a fatality of a reproductive female Indiana bat during Spring maternity season (or otherwise evidence of the presence of a maternity colony).

Response:
Criterion will coordinate with USFWS to evaluate the need for a permit amendment to increase the permitted take level and make any required adjustments in the habitat conservation plan minimization and mitigation measures to address the increased permitted take level.

8.2.2 Population Decline

WNS is an external factor impacting Indiana bats within the Appalachian Recovery Unit. In the northeastern U.S., WNS has lead to precipitous declines of cave-dwelling bat species including Indiana bat. In part to address this potential cumulative impact which is outside of the control of the Project, CPP will implement an off-site recovery-based mitigation project designed to provide a net benefit to Indiana bats within the Appalachian Mountain Recovery Unit. In addition CPP will meet and confer upon notification of USFWS that the authorized level of take in conjunction with WNS impacts could be having population-level impacts within the recovery unit and/or range-wide. The intent of the meeting will be to evaluate existing information related to the population decline, evaluate the best available data at the time regarding impacts from wind projects, and to determine strategies for addressing potentially significant impacts of the Project. Additional conservation measures that could be evaluated include implementation of bat deterrent technology, other turbine operation measures demonstrated to minimize on-site impacts to Indiana bats, or re-direction of mitigation funds to project(s) designed to address the Indiana bat population change. Due to the uncertainties around impacts and solutions to WNS, the outcome and need for additional action on the part of CPP are difficult to predict. If Indiana bat take from the Project has been negligible and/or the estimated take as determined by evaluation of impacts to other species is negligible, it is possible that no additional actions will be required; however, CPP, in consultation with the USFWS, will continue to monitor the population effects due to WNS to determine if future action is necessary. In the event of a catastrophic decline in the Indiana bat population, the potential for take may reach zero in which case the HCP/ITP would no longer be necessary. Under this scenario, CPP will evaluate with the USFWS the continued need for an ITP and to determine the appropriate action for retaining the permit.

The causes of WNS are not fully understood at this time; however, some parties have suggested that WNS may be caused by climatic change or other currently unknown factors outside the control of CPP. The Project is not contributing to the cause of climate change and conversely the Project by nature is designed to address climate change through the production of non-polluting electrical energy. In the event that climate change is a causal reason for WNS, and therefore population declines in bat species, the Project is in essence contributing to measures to curtail production of greenhouse gases, one of the primary causes of the current climate change trend.

Trigger:
USFWS notifies Criterion that the authorized level of take in conjunction with WNS impacts could be having population-level impacts within the recovery unit and/or range-wide.

Response:
Criterion will coordinate with USFWS to reevaluate the level of take and the minimization and mitigation measures are still adequate to address the impact of the take to the Appalachian Mountain Recovery Unit Indiana bat population. If Indiana bat take from the Project has been negligible and/or the estimated take as determined by evaluation of impacts to other species is negligible, it is possible that no additional actions will be required; however, CPP, in consultation with the USFWS, will continue to monitor the population effects due to WNS to determine if future action is necessary.

8.2.3 Additional Species Listings

Given that the potential future listing of other bat species, such as eastern small-footed myotis and northern long-eared myotis, as threatened or endangered due to current population declines and further potential declines due to WNS, CPP will seek a permit amendment to include any species previously documented within the Project that has been subsequently listed. A supplement to the HCP will be prepared that includes an impacts or the take evaluation and additional conservation measures as required for the new listed species (see also Section 8.4 below). Alternatively, in the event of a candidate species designation, CPP will consider amending the HCP to include the candidate species or prepare a Candidate Conservation Agreement. Upon notice from the USFWS of such listing(s), CPP will initiate consultation with the USFWS and determine if additional avoidance, minimization, or mitigation strategies, in addition to those implemented for Indiana bats, are required. CPP will use the best available data and information at the time to determine the need for additional conservation measures.

Trigger:
USFWS notifies CPP of a change in the listing status of any species that is not covered by the HCP. CPP will then determine if covered activities may result in take of the new listed species.

Response:
CPP will evaluate data from the monitoring study up to the time of the listing to determine if take of the previously unlisted species has occurred. In the event that take has been documented, or it is reasonably certain to occur, CPP will initiate consultation with the USFWS and prepare an amendment to the HCP (or other appropriate response such as seeking coverage under a programmatic HCP for the listed species, if one is available) that includes an impacts of the take evaluation and additional avoidance, minimization, or mitigation strategies to minimize and mitigate the impacts of the take of the new species. USFWS will amend the ITP with the additional conservation measures.

8.3 Unforeseen Circumstances

Unforeseen circumstances are defined as changes in circumstances affecting a species or geographic area covered by a conservation plan that could not reasonably have been anticipated by plan developers and the Service at the time of the negotiation and development of the plan and that result in a substantial and adverse change in the status of the covered species. (50 C.F.R. § 17.3).

The Service bears the burden of demonstrating that unforeseen circumstances exist using the best available scientific and commercial data available while considering certain factors. (50 C.F.R. §§ 17.22(b)(5)(iii)(C)). In deciding whether unforeseen circumstances exist, the Service shall consider, but not be limited to, the following factors (50 C.F.R. §§ 17.22(b)(5)(iii)(C)):

1. The size of the current range of the affected species;
2. The percentage of the range adversely affected by the covered activities;
3. The percentage of the range that has been conserved by the HCP;
4. The ecological significance of that portion of the range affected by the HCP;
5. The level of knowledge about the affected species and the degree of specificity of the conservation program for that species under the HCP; and
6. Whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the species in the wild.

In negotiating unforeseen circumstances, the Service will not require the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water or other natural resources beyond the level otherwise agreed upon for the species covered by the HCP without the consent of the permittee. (50 C.F.R. §§ 17.22(b)(5)(iii)(A)). If additional conservation and mitigation measures are deemed necessary to respond to unforeseen circumstances, the Service may require additional measures of the permittee where the HCP is being properly implemented only if such measures are limited to modifications within conserved habitat areas, if any, or to the HCP's operating conservation program for the affected species, and maintain the original terms of the plan to the maximum extent possible. (50 C.F.R. §§ 17.22(b)(5)(iii)(B)). Additional conservation and mitigation measures will not involve the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms of the conservation plan without the consent of the permittee.

Notwithstanding these assurances, nothing in the "No Surprises" Rule "will be construed to limit or constrain the [Service], any Federal agency, or a private entity, from taking additional actions, at its own expense, to protect or conserve a species included in a conservation plan." (50 C.F.R. §§ 17.22(b)(6)).

8.4 Permit Amendment

The HCP and/or ITP may be modified in accordance with the ESA, the Service's implementing regulations, the IA, and this chapter. HCP and permit modifications are not anticipated on a regular basis; however, modifications to the HCP and/or ITP may be requested by either CPP or the Service. The Service also may amend the ITP at any time for just cause, and upon a written finding of necessity, during the permit term in accordance with 50 C.F.R. § 13.23(b). The categories of modifications are administrative changes, minor amendments, and major amendments.

8.4.1 Administrative Changes

Administrative changes are internal changes or corrections to the HCP that may be made by CPP, at its own initiative, or approved by CPP in response to a written request submitted by the Service. Requests from the Service shall include an explanation of the reason for the change as well as any supporting documentation. Administrative changes on CPP's initiative do not require preauthorization or concurrence from the Service.

Administrative changes are those that will not (a) result in effects on a HCP species that are new or different than those analyzed in the HCP, EIS, or the Service's BO, (b) result in take beyond that authorized by the ITP, (c) negatively alter the effectiveness of the HCP, or (d) have consequences to aspects of the human environment that have not been evaluated. CPP will document each administrative change in writing and provide the Service with a summary of all changes, as part of its annual report, along with any replacement pages, maps, and other relevant documents for insertion in the revised document.

Administrative changes include, but are not limited to, the following:

- Corrections of typographical, grammatical, and similar editing errors that do not change intended meanings;
- Corrections of any maps or exhibits to correct minor errors in mapping; and
- Corrections of any maps, tables, or appendices in the HCP to reflect approved amendments, as provided below, to the HCP, IA, or ITP.

8.4.2 Minor Amendments

Minor amendments are changes to the HCP the effects of which on HCP species, the conservation strategy, and CPP's ability to achieve the biological goals and objectives of the HCP are either beneficial or not significantly different than those described in this HCP. Such amendments also will not increase impacts to species, their habitats, and the environment beyond those analyzed in the HCP, EIS, and the BO or increase the levels of take beyond that authorized by the ITP. Minor amendments may require an amendment to the ITP or the IA. A proposed minor amendment must be approved in writing by the Service and CPP before it may be implemented. A proposed minor amendment will become effective on the date of the joint written approval.

CPP or the Service may propose minor amendments by providing written notice to the other party. The party responding to the proposed minor amendment shall respond within thirty (30) days of receiving notice of such a proposed modification. Such notice shall satisfy the provisions of 50 C.F.R. § 13.23 as well as include a description of the proposed minor amendment; the reasons for the proposed amendment; an analysis of the environmental effects, if any, from the proposed amendment, including the effects on HCP species and an assessment of the amount of take of the species; an explanation of the reason(s) the effects of the proposed amendment conform to and are not different from those described in this HCP; and any other information required by law. When CPP proposes a minor amendment to the HCP, the Service may approve or disapprove such amendment, or recommend that the amendment be processed as a major amendment as provided below. The Service will provide CPP with a written explanation for its decision. When the Service proposes a minor amendment to the HCP, CPP may agree to adopt such amendment or choose not to adopt the amendment. CPP will provide the Service with a written explanation for its decision. The Service retains its authority to amend the ITP, however, consistent with 50 C.F.R. § 13.23.

Provided a proposed amendment is consistent in all respects with the criteria in the first paragraph of this section, minor amendments include, but are not limited to, the following:

- Minor changes to the biological goals or objectives;
- Modification of monitoring protocols for HCP effectiveness or modifying or adopting HCP monitoring protocols to align with any future modifications to the protocols by the USFWS;
- Modification of existing, or adoption of new, incidental take avoidance measures;
- Modification of existing, or adoption of additional, minimization and mitigation measures that improve the likelihood of achieving HCP species objectives;
- Discontinuance of implementation of conservation measures if they prove ineffective;
- Minor changes to the reporting protocol.

8.4.3 Major Amendments

A major amendment is any proposed change or modification that does not satisfy the criteria for an administrative change or minor amendment. Major amendments to the HCP and ITP are required if CPP desires, among other things, to modify the projects and activities described in the HCP such that they may affect the impact analysis or conservation strategy of the HCP, affect other environmental resources or other aspects of the human environment in a manner not already analyzed, or result in a change for which public review is required. Major amendments must comply with applicable permitting requirements, including the need to comply with NEPA, the NHPA, and Section 7 of the ESA.

In addition to the provisions of 50 C.F.R. § 13.23(b), which authorize the Service to amend an ITP at any time for just cause and upon a finding of necessity during the permit term, the HCP and ITP may be modified by a major amendment upon CPP's submission of a formal permit amendment application and the required application fee to the Service, which shall be processed in the same manner as the original permit application. Such application generally will require submittal of a revised Habitat Conservation Plan, a revised IA, and preparation of an environmental review document in accordance with NEPA. The specific document requirements for the application may vary, however, based on the substance of the amendment. For instance, if the amendment involves an action that was not addressed in the original HCP, IA, or NEPA analysis, the documents may need to be revised or new versions prepared addressing the proposed amendment. If circumstances necessitating the amendment were adequately addressed in the original documents, an amendment of the ITP might be all that would be required.

Upon submission of a complete application package, the Service will publish a notice of the receipt of the application in the Federal Register, initiating the NEPA and HCP public comment process. After the close of the public comment period, the Service may approve or deny the proposed amendment application. CPP may, in its sole discretion, reject any major amendment proposed by the Service.

Changes that would require a major amendment to the HCP and/or ITP include, but are not limited to:

- Revisions to the covered lands or activities that do not qualify as a minor amendment;
- Increases in the amount of take allowed for covered activities;
- A renewal or extension of the permit term beyond 50 years, where the criteria for a major amendment are otherwise met, and where such request for renewal is in accordance with 50 C.F.R. § 13.22.

8.5 Permit Renewal

It is requested that the ITP associated with this HCP is renewable pursuant to 50 CFR 13.22. In the event that CPP plans to continue to operate the Criterion Wind Project after the permit term, CPP will file in writing a renewal request at least 30 days prior to the permit expiration.

9.0 REFERENCES

9.1 Literature Cited

Arnett, E.B., W.K. Brown, W.P. Erickson, J.K. Fiedler, B.L. Hamilton, T.H. Henry, A.Jain, G.D. Johnson, R.R. Koford, C.P. Nicholson, T.J. O'connell, M.D. Piorkowski, and R.D. Tankersley Jr. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. Journal of Wildlife Management 72:61–78.

Arnett, E.B., W.P. Erickson, J. Kerns, and J. Horn. 2005. Relationships Between Bats and Wind Turbines in Pennsylvania and West Virginia: An Assessment of Fatality Search Protocols, Patterns of Fatality, and Behavioral Interactions with Wind Turbines. Final Report prepared for the Bats and Wind Energy Cooperative. Bat Conservation International (BCI), Austin, Texas. June 2005.

Arnett, E.B., J.P. Hayes, and M.M.P. Huso. 2006. An Evaluation of the Use of Acoustic Monitoring to Predict Bat Fatality at a Proposed Wind Facility in South- Central Pennsylvania. An annual report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International (BCI), Austin, Texas

Arnett, E.B., M. Schirmacher, M.M.P. Huso, J.P. Hayes. 2009a. Patterns of bat fatality at the Casselman Wind Project in South-Central Pennsylvania, 2008 Annual Report. Prepared for the Bats and Wind Energy Cooperative (BWEC) and the Pennsylvania Game Commission. June 2009.

Arnett, E.B., M. Schirmacher, M.M.P. Huso, and J.P. Hayes. 2009b. Effectiveness of changing wind turbine cut-in speed to reduce bat fatalities at wind facilities. An annual report submitted to the Bats and Wind Energy Cooperative, Bat Conservation International, Austin, Texas, USA.

Baerwald, E. 2007. Bat Fatalities in Southern Alberta. Proceeding of the Wildlife Research Meeting VI, November 2006, San Antonio, Texas. National Wind Coordinating Collaborative (NWCC).

Baerwald, E.F., D'Amours, G.H., Klug, B.J., and Barclay, R.M.R. 2008. Barotrauma is a significant cause of bat fatalities at wind turbines. Current Biology 18: R695-R696.

Barclay, R.M.R. and L.M. Harder. 2005. Life Histories of Bats: Life in the Slow Lane. *In*: Bat Ecology. T. H. Kunz and M. B. Fenton, eds. University of Chicago Press, Chicago, Illinois. Pp. 209-253.

Barclay, R.M.R. and A. Kurta.2007 Ecology and Behavior of Bats Roosting in Tree Cavities and Under Bark.*In*: Bats in Forests: Conservation and Management. Lacki, M.J., J. P. Hayes and A. Kurta, eds. Johns Hopkins University Press, Baltimore, Maryland. Pp. 17-59.

Beverly, J. and M. Gumbert. 2004. Indiana Bats in West Virginia: a Review. *In*: Indiana Bat and Coal Mining: A Technical Interactive Forum. K. C. Vories and A. Harrington, eds. US Department of Interior, Office of Surface Mining, Alton, Illinois, and Coal Research Center, Southern Illinois University, Carbondale, Illinois, Louisville, Kentucky. Pp. 139–148.

Blehert, D.S., A.C. Hicks, M. Behr, C.U. Meteyer, B.M. Berlowski-Zier, E.L. Buckles, J.T.H. Coleman, S.R. Darling, A. Gargas, R. Niver, J.C. Okoniewski, R.J. Rudd, and W.B. Stone. 2009. Bat white-nose syndrome: an emerging fungal pathogen. Science 323:227.

Boyles, J.G., J.J. Storm, and V. Brack. 2008. Thermal benefits of clustering during hibernation: a field test of competing hypotheses on *Myotis sodalis*. Functional Ecology 22:632-636.

Brack, V. Jr. 2004. The Biology and Life History of the Indiana Bat: Hibernacula. *In*: Indiana Bat and Coal Mining: A Technical Interactive Forum.Vories, K.C. and A. Harrington, eds. Louisville, Kentucky: U.S. Department of the Interior (USDOI), Office of Surface Mining, Alton, Illinois, and Illinois Coal Research Center, Southern Illinois University, Carbondale, Illinois. Pp. 7-14.

Brack, V. Jr., C.W. Stihler, R.J. Reynolds, C.M. Butchkoski, and C.S. Hobson. 2002. Effect of Climate and Elevation on Distribution and Abundance in the Mideastern United States. *In*: The Indiana Bat: Biology and Management of an Endangered Species. Kurta, A. and J. Kennedy, eds. Bat Conservation International (BCI), Austin, Texas. Pp. 21-28.

Britzke, E.R. 2003. Spring Roosting Ecology of Female Indiana Bats (*Myotis sodalis*) in the Northeastern United States: U.S. Fish and Wildlife Service (USFWS), New England Field Office, Concord, New Hampshire.

Britzke, E.R., Harvey, M.J., and Loeb, S.C. 2003. Indiana bat, *Myotis sodalis*, maternity roosts in the southern United States. Southeastern Naturalist 2:235-242.

Britzke, E.R., Hicks, A.C., Von Oettingen, S.L., and Darling, S.R. 2006.Description of spring roost trees used by female Indiana bats (*Myotis sodalis*) in the Lake Champlain Valley of Vermont and New York. American Midland Naturalist 155:181-187.

Butchkoski, C.M. and J. Hassinger.2002a. Ecology of a Maternity Colony Roosting in a Building. *In*:The Indiana Bat: Biology and Management of an Endangered Species. Kurta, A. and J. Kennedy, eds. Bat Conservation International (BCI), Austin, Texas. Pp. 130-142.

Butchkoski, C.M. and J. Hassinger, J. 2002b. Indiana Bat Telemetry Studies: Pennsylvania Game Commission, Harrisburg, Pennsylvania.

Butchkoski, C.M. and G. Turner. 2005. Indiana Bat (*Myotis sodalis*) Investigations at Canoe Creek, Blair County, Pennsylvania. Pennsylvania Game Commission, Harrisburg, Pennsylvania.

Butchkoski, C.M. and G. Turner. 2006. Indiana Bat (*Myotis sodalis*) Summer Roost Investigations. Pennsylvania Game Commission, Harrisburg, Pennsylvania.

Callahan, E.V. 1993 Indiana Bat Summer Habitat Requirements.M.S. Thesis, University of Missouri, Columbia, Missouri.84 pp.

Callahan, E.V., R.D. Drobney, and R.L. Clawson. 1997. Selection of Summer Roosting Sites by Indiana Bats (*Myotis sodalis*) in Missouri. Journal of Mammalogy78: 818-825.

Capouillez, W. and T. Librandi-Mumma. 2008. Pennsylvania Game Commission, Wind Energy Voluntary Cooperation Agreement First Annual Report, April 18, 2007 – September 30, 2008. Bureau of Wildlife Habitat Management, Pennsylvania Game Commission. December 31, 2008.

Chaturvedi, V., D.J. Springer, M. Behr, R. Ramani, X. Li, M.K. Peck, P. Ren, D.J. Bopp, B. Wood, W.A. Samsonoff, C.M. Butchkoski, A.C. Hicks, W.B. Stone, R.J. Rudd, and Chaturvedi, S. 2010. Morphological and molecular characteristics of psychrophilic fungus *Geomyces destructans* from new York bats with White Nose Syndrome (WNS). PLoS ONE 5.

Clark, B.K., J.B. Bowles, and B.S. Clark.1987. Summer Status of the Endangered Indiana Bat in Iowa.American Midland Naturalist118: 32-39.

Cope, J.B. and S.R. Humphrey. 1977. Spring and Autumn Swarming Behavior in the Indiana Bat, *Myotis sodalis*. Journal of Mammalogy58: 93-95.

Cope, J.B., A.R. Richter, and R.S. Mills. 1974. A Summer Concentration of the Indiana Bat, *Myotis sodalis*, in Wayne County, Indiana. Proceedings of the Indiana Academy of Science 83: 482-484.

Cryan, P.M. 2008. Mating behavior as a possible cause of bat fatalities at wind turbines. Journal of Wildlife Management 72:845-849.

Endangered Species Act (ESA). 1973. 16 United States Code § 1531-1544. December 28, 1973.

Fiedler, J.K. 2004.Assessment of Bat Mortality and Activity at Buffalo Mountain Windfarm, Eastern Tennessee. M.S. Thesis. University of Tennessee, Knoxville.

Fiedler,J.K., T. H. Henry, R. D. Tankersley, and C. P. Nicholson. 2007. Results of Bat and Bird Mortality Monitoring at the Expanded Buffalo Mountain Windfarm, 2005. Tennessee Valley Authority, June 28, 2007.

Fleming, T.H. and P. Eby. 2005. Ecology of Bat Migration. *In*:Bat Ecology. T.H. Kunz and M.B. Fenton, eds. The University of Chicago Press, Chicago, Illinois. Pp. 156-208.

Frick, W.F., Pollock, J.F., Hicks, A.C., Langwig, K.E., Reynolds, D.S., Turner, G.G., Butchkoski, C.M., and Kunz, T.H. 2010. An Emerging Disease Causes Regional Population Collapse of a Common North American Bat Species. Science 329:679-682.

Gardner, J.E. and E.A. Cook. 2002. Seasonal and Geographic Distribution and Quantification of Potential Summer Habitat. *In*: The Indiana Bat: Biology and Management of an Endangered Species. Kurta, A. and J. Kennedy, eds. Bat Conservation International (BCI), Austin, Texas. Pp. 9-20.

Gates, J.E., Kerns, J., Lott, K., and Johnson, J.B. 2006.Bird and Bat Species and Risks to Diurnal Migrants on the Clipper Windpower Criterion Project, Backbone Mountain, Garrett County, Maryland. Final Report. Submitted to: Maryland Department of Natural Resource, Power Plant Research Program (PPRP), Annapolis, Maryland.

Gruver, J.C. 2002.Assessment of Bat Community Structure and Roosting Habitat Preferences for the Hoary Bat (*Lasiurus cinereus*) near Foote Creek Rim, Wyoming. M.S. Thesis. University of Wyoming, Laramie, Wyoming.149 pp.

Gruver, J., M. Sonnenburg, K. Bay, and W. Erickson. 2009. Post-Construction Bat and Bird Fatality Study at the Blue Sky Green Field Wind Energy Center, Fond Du Lac County, Wisconsin July 21 - October 31, 2008 and March 15 - June 4, 2009. Unpublished report prepared by Western EcoSystems Technology, Inc., Cheyenne, Wyoming. December 17, 2009.

Gruver, J., S. Howlin, C. Nations and T. McDonald. 2010. Using Discriminant Function Analysis and Other Quantitative Techniques to Classify Bat Echolocation Calls. Presented at the National Wind Coordinating Collaborative Wind Wildlife Research Meeting VIII, October 19-21, 2010, Lakewood, Colorado.

Gruver, J. 2011. Bat Studies at theCriterion Wind ProjectGarrett County, Maryland, Final Report, April 1 – November 15, 2010. Prepared for: Constellation Energy, Baltimore, Maryland.Prepared by: WEST, Inc., Laramie, Wyoming.

Gumbert, M.W., J.M. O'Keefe and J.R. MacGregor. 2002. Roost Fidelity in Kentucky. *In*: The Indiana Bat: Biology and Management of an Endangered Species. Kurta, A. and J. Kennedy, eds. Bat Conservation International (BCI), Austin, Texas. Pp. 143-152.

Guthrie, M.J. 1933. The Reproductive Cycles of Some Cave Bats. Journal of Mammalogy14: 199-216.

Henry, M., D.W. Thomas, R. Vaudry and M. Carrier 2002.Foraging Distances and Home Range of Pregnant and Lactating Little Brown Bats (*Myotis lucifugus*).Journal of Mammalogy83: 767-774.

Hicks, A. 2004. Indiana Bat (*Myotis sodalis*): Protection and Management in New York State. Endangered Species Investigations Performance Report. Prepared for project number W-166-E Segment 2003-2004, New York Department of Environmental Conservation.15 pp.

Hicks, A., M. Clark, M. Cooper, and C. Herzog.2006. Glen Park – Williams Complex Spring Emergence Tracking 2005 Project Summary. New York Department of Environmental Conservation. Prepared July 20, 2006.12 pp.

Hicks, A.C. and P.G. Novak. 2002. History, Status, and Behavior of Hibernating Populations in the Northeast. *In*: The Indiana Bat: Biology and Management of an Endangered Species. Kurta, A. and J. Kennedy, eds. Bat Conservation International (BCI), Austin, Texas. Pp. 35-47.

Howe, R.W., W. Evans, and A.T. Wolf. 2002. Effects of Wind Turbines on Birds and Bats in Northeastern Wisconsin. Wisconsin Public Service Corporation, Madison, Wisconsin.

Hoying, K.M. and T.H. Kunz. 1998. Variation in size at birth and post-natal growth in the insectivorous bat *Pipistrellus subflavus* (Chiroptera: Vespertilionidae). J. Zool., Lond. 245:15-27.

Humphrey, S.R. and J.B. Cope. 1977. Survival Rates of the Endangered Indiana Bat, *Myotis sodalis*. Journal of Mammalogy 58: 32-36.

Humphrey, S.R., A.R. Richter and J.B. Cope.1977. Summer Habitat and Ecology of the Endangered Indiana Bat, *Myotis sodalis*. Journal of Mammalogy 58: 334-346.

Jain, A., P. Kerlinger, R. Curry, and L. Slobodnik. 2007. Annual Report for the Maple Ridge Wind Power Project: Post-Construction Bird and Bat Fatality Study – 2006. Final report. Prepared for PPM Energy and Horizon Energy and Technical Advisory Committee (TAC) for the Maple Ridge Project Study.

Jain, A., P. Kerlinger, R. Curry, and L. Slobodnik. 2008. Annual Report for the Maple Ridge Wind Power Project: Post-Construction Bird and Bat Fatality Study – 2007. Final report. Prepared for PPM Energy and Horizon Energy and Technical Advisory Committee (TAC) for the Maple Ridge Project Study.

Jain, A., P. Kerlinger, R. Curry, and L. Slobodnik. 2009. Annual Report for the Maple Ridge Wind Power Project, Post-Construction Bird and Bat Fatality Study – 2008, February 16, 2009. Final report. Prepared for Iberdrola Renewables, Inc. and Horizon Energy and Technical Advisory Committee (TAC) for the Maple Ridge Project Study.

Johnson, G.D. 2005. A Review of Bat Mortality at Wind Energy Developments in the United States. Bat Research News 46: 45-49.

Johnson, G.D., M.K. Perlik, W.P. Erickson, M.D. Strickland, and P. Sutherland, Jr. 2003. Bat Interactions with Wind Turbines at the Buffalo Ridge, Minnesota Wind Resource Area: An Assessment of Bat Activity, Species Composition, and Collision Mortality. Electric Power Research Institute, Palo Alto, California, and Xcel Energy, Minneapolis, Minnesota.

Johnson, G.D., and W.P. Erickson. 2008. Final Report, Avian and Bat Cumulative Impacts Associated with Wind Energy Development in the Columbia Plateau Ecoregion of Eastern Washington and Oregon. Prepared for Klickitat County Planning Department.Western EcoSystems Technology, Inc., Cheyenne, Wyoming. October 30, 2008.

Kerlinger, P., R. Curry, A. Hasch, and J. Guarnaccia. 2007. Migratory Bird and Bat Monitoring Study at the Crescent Ridge Wind Power Project, Bureau County, Illinois: September 2005-August 2006. Technical Report prepared for Orrick Herrington and Sutcliffe, LLC. Prepared by Curry & Kerlinger, LLC., McLean, Virginia. 41 pp.

Kerns, J. and P. Kerlinger. 2004. A Study of Bird and Bat Collision Fatalities at the MWEC Wind Energy Center, Tucker County, West Virginia: Annual Report for 2003. Technical report prepared by Curry and Kerlinger, LLC. for FPL Energy and MWEC Wind Energy Center Technical Review Committee.

Kurta, A. 2004 Roosting Ecology and Behavior of Indiana Bats (*Myotis sodalis*) in Summer. *In*: Indiana Bat and Coal Mining: A Technical Interactive Forum. K.C. Vories and A. Harrington, eds. U.S. Department of Interior, Office of Surface Mining, Alton, Illinois Coal Research Center, Southern Illinois University, Carbondale, Illinois. Louisville, Kentucky. Pp. 29-42.

Kurta, A. and S.W. Murray. 2002. Philopatry and Migration of Banded Indiana Bats (*Myotis sodalis*) and Effects of Radio Transmitters. Journal of Mammalogy83: 585-589.

Kurta, A., S.W. Murray, and D.H. Miller. 2002. Roost Selection and Movements across the Summer Landscape. *In*: The Indiana Bat: Biology and Management of an Endangered Species. Kurta, A. and J. Kennedy, eds. Bat Conservation International (BCI), Austin, Texas. Pp. 118-129.

Kurta, A. and H. Rice. 2002. Ecology and Management of the Indiana Bat in Michigan. Michigan Academician 33: 361-376.

Kurta, A. and J.A. Teramino. 1994. A Novel Hibernaculum and Noteworthy Records of the Indiana Bat and Eastern Pipistrelle (Chiroptera: Vespertilionidae). American Midland Naturalist132: 410-413.

Kurta, A., K.J. Williams, and R. Mies. 1996. Ecological, Behavioral, and Thermal Observations of a Peripheral Population of Indiana Bats (*Myotis sodalis*). *In*: Bats and Forests. Barclay R.M.R. and R.M. Brigham, eds. Research Branch, Ministry of Forests, Province of British Columbia. Victoria, British Columbia, Canada. Pp. 102-117.

Lacki, M. J., S.K. Amelon, and M.D. Baker. 2007. Foraging Ecology of Bats in Forests. *In*: Bats in Forests: Conservation and Management Lacki, M.J., J.P. Hayes, and A. Kurta, eds. Johns Hopkins University Press, Baltimore, Maryland. Pp. 17-59.

Miller, N.E., R.D. Drobney, R.L. Clawson, and E.V. Callahan.2002. Summer Habitat in Northern Missouri. *In*: The Indiana Bat: Biology and Management of an Endangered Species. Kurta, A. and J. Kennedy, eds. Bat Conservation International (BCI), Austin, Texas. Pp. 165-171.

Mumford, R.E. and L.L. Calvert. 1960. *Myotis sodalis* Evidently Breeding in Indiana. Journal of Mammalogy 41: 512.

Murray, S.W. and A. Kurta. 2004 Nocturnal Activity of the Endangered Indiana Bat (*Myotis sodalis*). Journal of Zoology 262: 197-206.

National Wind Coordinating Collaborative (NWCC). 2010. Wind Turbine Interactions with Birds, Bats, and their Habitats: A Summary of Research Results and Priority Questions. [https://www.nationalwind.org/assets/publications/Birds_and_Bats_Fact_Sheet_.pdf].

O'Shea, T.J., Ellison, L.E., and Stanley, T.R. 2004. Survival Estimation in Bats: Historical Overview, Critical Appraisal, and Suggestions for New Approaches. *In*: Sampling Rare or Elusive Species: Concepts, Designs, and Techniques for Estimating Population Parameters. Thompson, W.L., ed. Island Press, Washington. Chapter 15, Pp.297-336.

Parham, G. 2010. U.S. Fish and Wildlife Service and Wind Farm Owners Work Together. USFWS Press release, February 8, 2010.

Racey, P.A. 1973. Environmental factors affecting length of gestation in hetero-thermic bats. Journal of Reproduction and Fertility 19 (suppl.): 175-189.

Redell, D, E.B. Arnett, J.P. Hayes, and M.M.P Huso. 2006. Patterns of Pre-Construction Bat Activity Determined Using Acoustic Monitoring at a Proposed Wind Facility in South-Central Wisconsin. An annual report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International (BCI), Austin, Texas.

Sanders, C., J. Chenger, and B. Denlinger. 2001. Williams Lake Telemetry Study: New York Indiana Bat Spring Migration Tracking Study. Report for Bat Conservation and Management. 21 pp. www.batmanagement.com

Sparks, D.W., C.M. Ritzi, J.E. Duchamp and J.O. Whitaker Jr. 2005.Foraging Habitat of the Indiana Bat (*Myotis sodalis*) in an Urban-Rural Interface. Journal of Mammalogy 86: 713-718.

Sparks, D.W., J.O. Whitaker Jr., and C.M. Ritzi. 2004. Foraging Ecology of the Endangered Indiana Bat. *In*: Indiana Bat and Coal Mining: A Technical Interactive Forum. Vories, K.C. and A. Harrington, eds. U.S. Department of Interior, Office of Surface Mining, Alton, Illinois Coal Research Center, Southern Illinois University, Carbondale, Illinois. Louisville, Kentucky. Pp. 15-27.

SWCA Environmental Consultants (SWCA).2010. Kahuku Wind Power Habitat Conservation Plan. Prepared for: Kahuku Wind Power LLC., c/o First Wind, Kahului, Hawaii. Prepared by: SWCA Environmental Consultants, Honolulu, Hawaii. March 2010.

Thomson, C.E. 1982. *Myotis sodalis*. Mammalian Species. The American Society of Mammalogists 163:1-5.

Tuttle, M. D. and Kennedy, J. 2002 Thermal Requirements during Hibernation. *In*: The Indiana Bat: Biology and Management of an Endangered Species. Kurta, A. and J. Kennedy, eds. Bat Conservation International (BCI), Austin, Texas. Pp. 68-78.

U.S. Fish and Wildlife Service (USFWS). 1983. Recovery Plan for the Indiana Bat. USFWS, Washington, DC.80 pp.

U.S. Fish and Wildlife Service (USFWS). 1999. Agency draft. Indiana Bat (*Myotis sodalis*) Revised Recovery Plan. USFWS, Fort Snelling, Minnesota.

U.S. Fish and Wildlife Service (USFWS). 2003. Service Interim Guidance on Avoiding and Minimizing Impacts from Wind Turbines. USFWS. Washington, D.C. May 13, 2003.

U.S. Fish and Wildlife Service (USFWS). 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. U.S. Department of Interior, Fish and Wildlife Service, Region 3, Fort Snelling, Minnesota.260 pp.

U.S. Fish and Wildlife Service (USFWS). 2008. Revised 2007 Rangewide Population Estimate for the Indiana Bat, *Myotis sodalis*. USFWS, Region 3. October 15, 2008. www.fws.gov/midwest

U.S. Fish and Wildlife Service (USFWS). 2009. Indiana Bat (*Myotis sodalis*) 5-Year Review: Summary and Evaluation. USFWS, Midwest Region - Region 3, Bloomington Ecological Field Office, Bloomington, Indiana. September 2009.

U.S. Fish and Wildlife Service (USFWS). 2011. 2009 (revised) Rangewide Population Estimate for the Indiana Bat (*Myotis sodalis*). http://www.fws.gov/midwest/endangered/mammals/inba/inba_2009pop.html

U.S. Fish and Wildlife Service (USFWS). 2010. White-Nose Syndrome in Bats: About WNS. http://www.fws.gov/northeast/wnsabout.html

U.S. Fish and Wildlife Service (USFWS), Interstate Mining Compact Commission (IMCC), and U.S.D.I Office of Surface Mining (OSM). 2009. Range-wide Indiana Bat Protection and Enhancement Plan Guidelines.

U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). 1996. Habitat Conservation Planning and Incidental Take Permit Processing Handbook. November 4, 1996.

Vonhof, M.J. and R.M.R. Barclay. 1996. Roost-Site Selection and Roosting Ecology of Forest-Dwelling Bats in British Columbia. Canadian Journal of Zoology 74: 1797-1805.

Watrous, K.S., T.M. Donovan, R.M. Mickey, S.R. Darling, A.C. Hicks, and S.L. von Oettingen. 2006. Predicting Minimum Habitat Characteristics for the Indiana Bat in the Champlain Valley. Journal of Wildlife Management 70: 1228-1237.

Whitaker, J.O. Jr. and V. Brack Jr. 2002.Distribution and Summer Ecology in Indiana.*In*:The Indiana Bat: Biology and Management of an Endangered Species. Kurta, A. and J. Kennedy, eds. Bat Conservation International (BCI), Austin, Texas. Pp. 48-54.

Wilde, C.J., C.H. Knight, and P.A. Racey. 1999. Influence of Torpor on Milk Protein Composition and Secretion in Lactating Bats. Journal of Experimental Biology 284: 35-41.

Wind Turbine Guidelines Advisory Committee (WTGAC). 2010. U.S. Fish and Wildlife Service Wind Turbine Guidelines Advisory Committee, Preamble to the Committee Recommendations, Committee Policy Recommendations, Committee Recommended Guidelines. Submitted to the Secretary of the Interior, March 4, 2010.162 pp.

Winhold, L., E. Hough and A. Kurta.2005 Long-Term Fidelity of Tree-Roosting Bats to a Home Area. Bat Research News46: 9-10.

Winhold, L. and A. Kurta. 2006 Aspects of Migration by the Endangered Indiana Bat, *Myotis sodalis*. Bat Research News46: 9-10.

Woodward, S. L., and R. L. Hoffman. 1991. The Nature of Virginia. *In*: Virginia's Endangered Species: Proceedings of a Symposium. K. Terwilliger (coordinator). McDonald and Woodward Publishing Company, Blacksburg, Virginia. Pp. 23-48.

Young, D.P. Jr., W.P. Erickson, R.E. Good, M.D. Strickland, and G.D. Johnson. 2003. Avian and Bat Mortality Associated with the Initial Phase of the Foote Creek Rim Wind Power Project, Carbon County, Wyoming: November 1998 - June 2002. Technical Report prepared by Western EcoSystems Technology Inc. for Pacificorp, Inc., SeaWestWindpower, Inc. and Bureau of Land Management. 35 pp.

Young, D.P., Jr., W.P. Erickson, K. Bay, S. Nomani, and W. Tidhar. 2009a. Mount Storm Wind Energy Facility, Phase 1 Post-Construction Avian and Bat Monitoring, July – October 2008. Prepared for*:* NedPower Mount Storm, LLC, Houston, Texas. Prepared by: Western EcoSystems Technology, Inc., Cheyenne, Wyoming.

Young, D.P., Jr., W.P. Erickson, K. Bay, S. Nomani, and W. Tidhar. 2009b. Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring, March – June 2009. Prepared for*:* NedPower Mount Storm, LLC, Houston, Texas. Prepared by: Western EcoSystems Technology, Inc., Cheyenne, Wyoming.

Young, D.P., Jr., K. Bay, S. Nomani, and W.L. Tidhar.2010. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: July - October 2009. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming.

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